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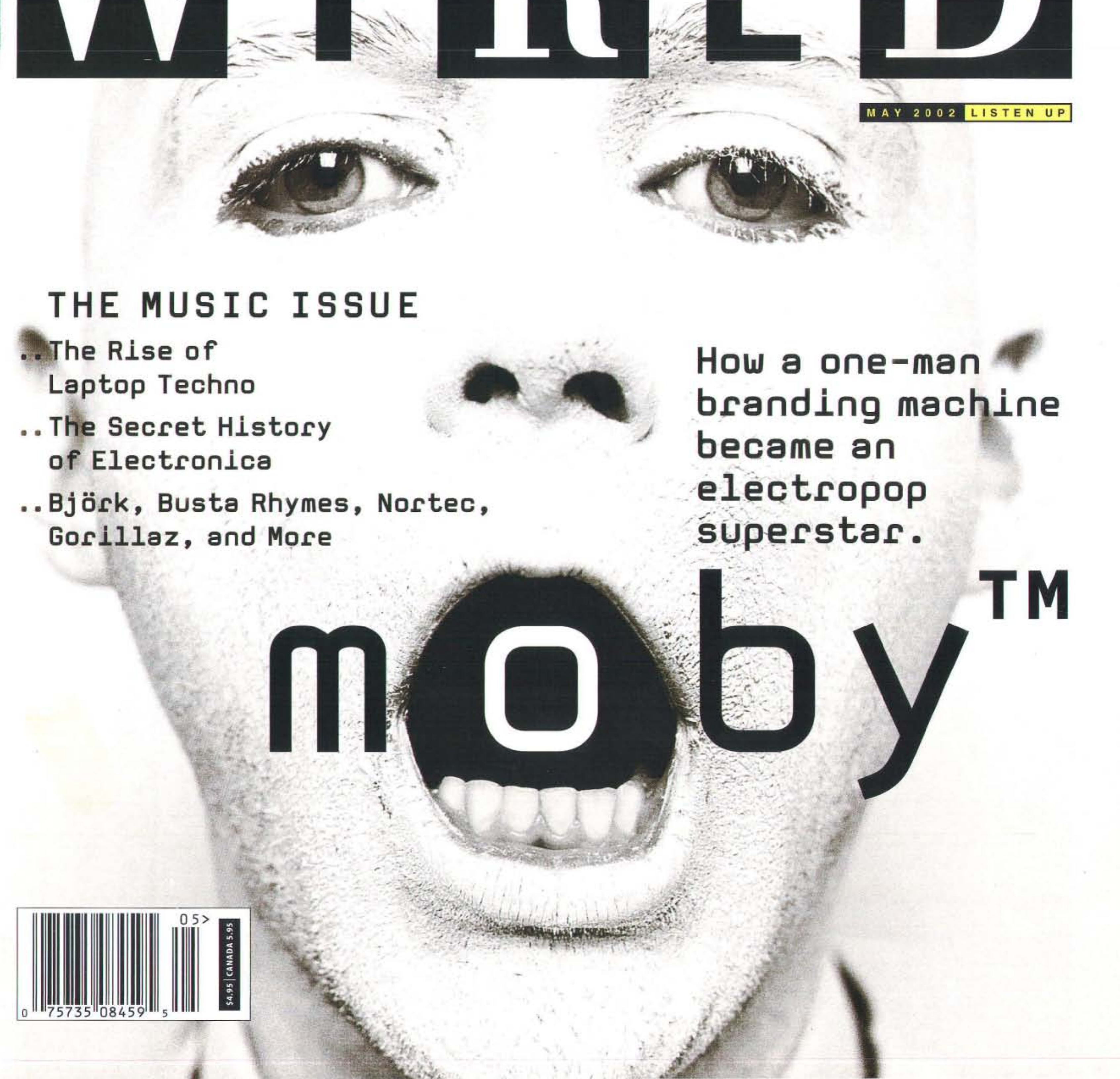

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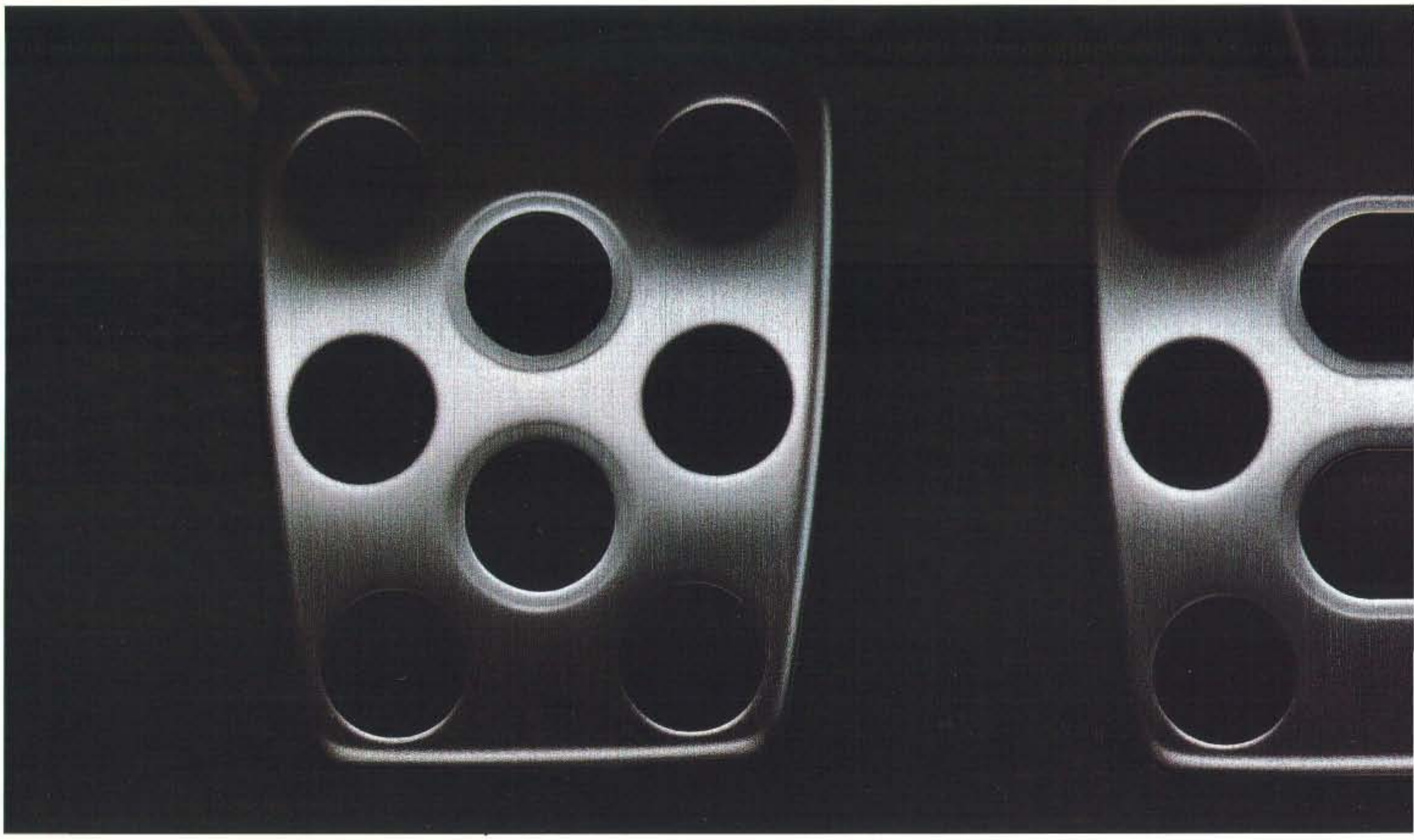

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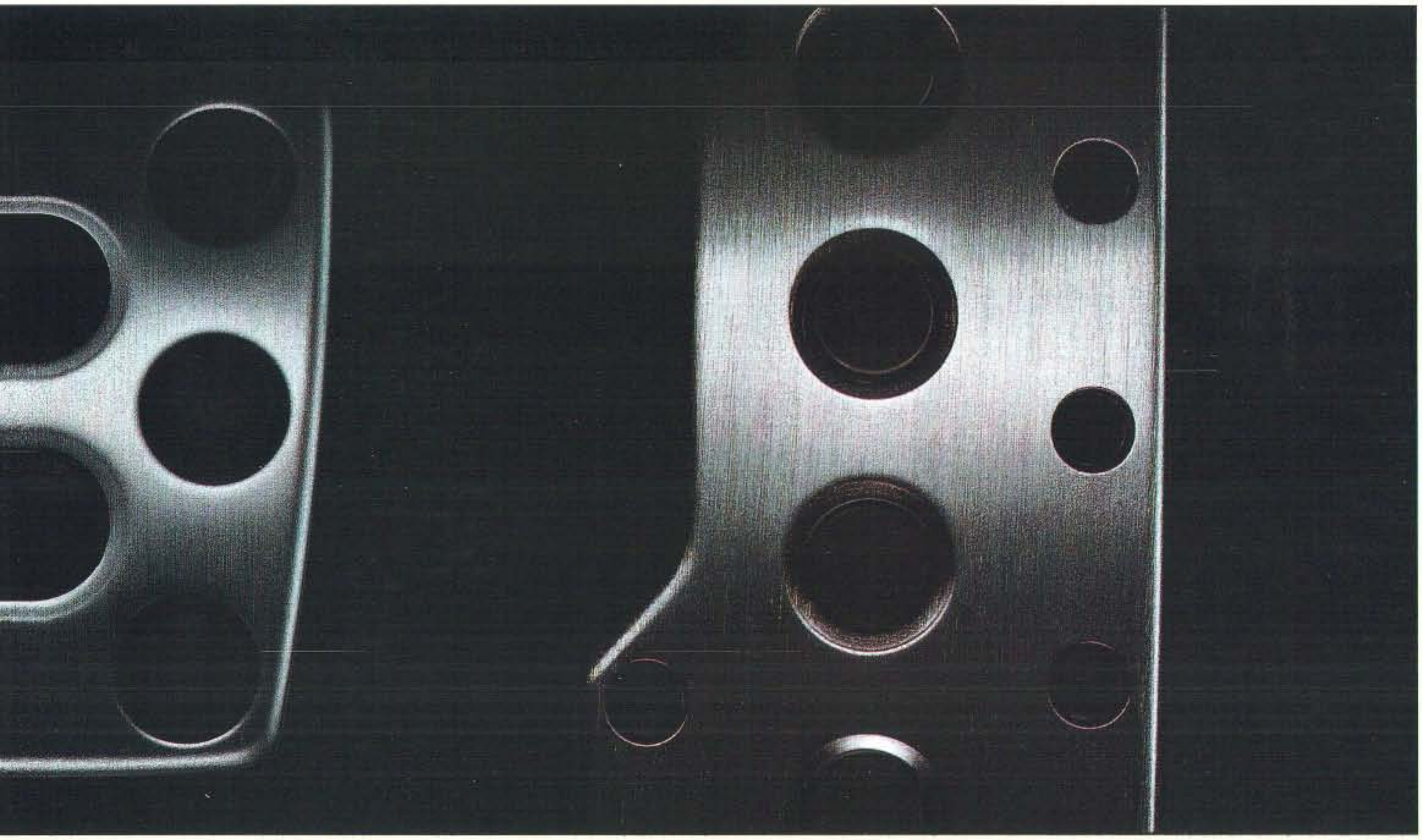

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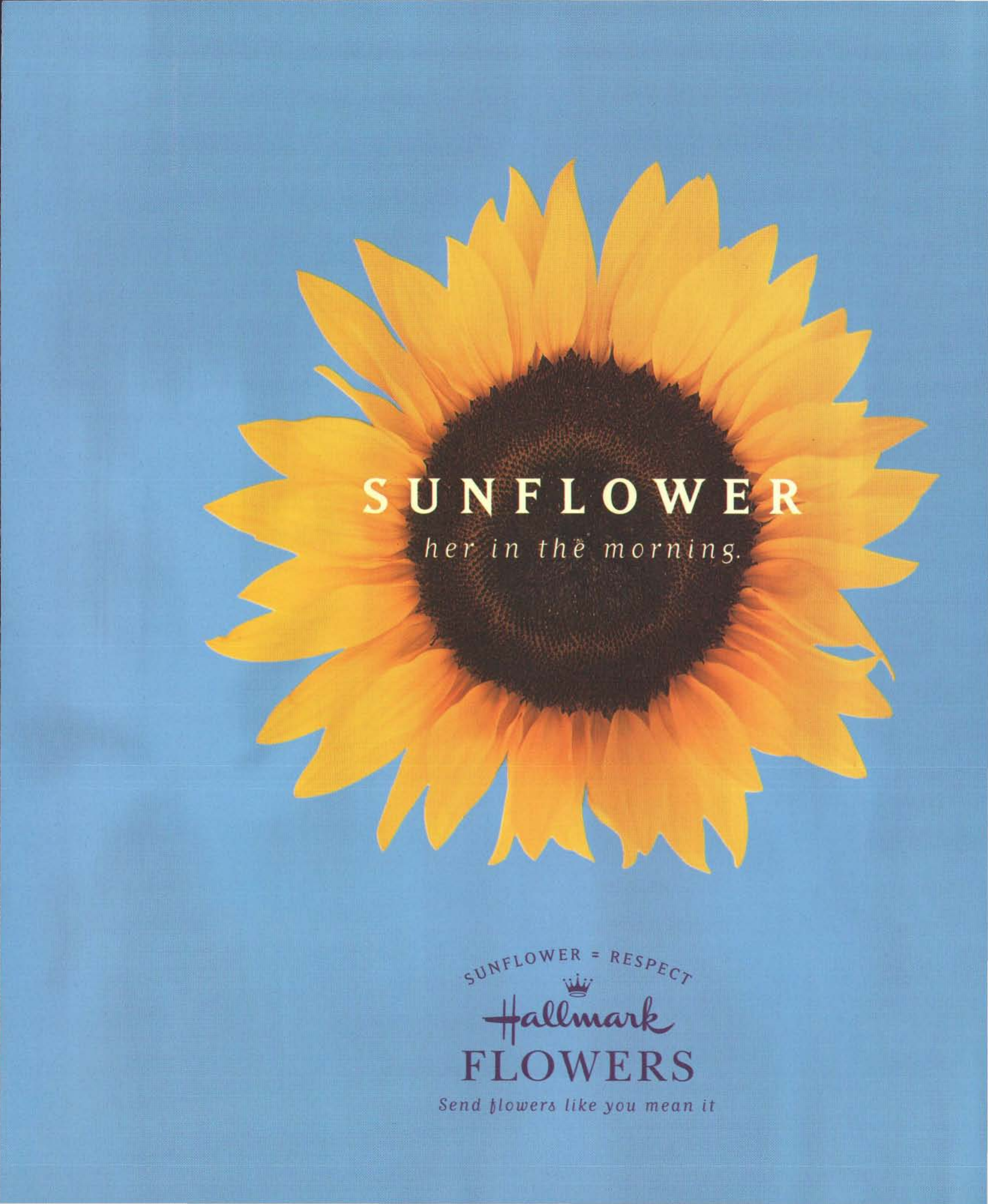
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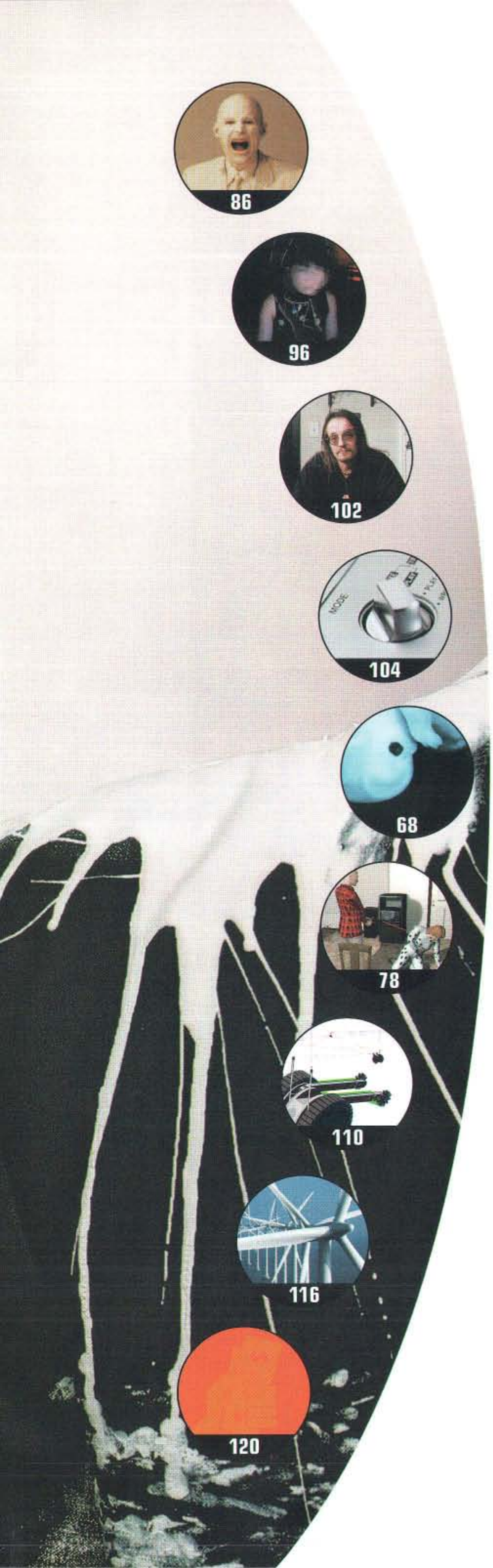

WIRED

May 2002 10.05

FEATURES

THE MUSIC ISSUE

86 Moby™

How a one-man branding machine became an electropop superstar. By Ethan Smith

PLUS: Björk, Busta Rhymes, Gorillaz, Malcolm McLaren …

96 The Rise of Laptop Techno

First software turned the computer into a musical instrument. Now who's in control: the CPU or the musician? By Erik Davis

102 Master of the File-Sharing Universe

Meet Dan Verner, the one-stop shop for everything from MP3s to *A Beautiful Mind* and every Game Boy title on the market.
By Jeffrey M. O'Brien

104 Electronica's Secret History

The inside story of six machines that changed the music world.
By Pat Blashill

68 The Rebirth of Eugenics

Artificial chromosomes, in vitro screening – the question is not whether we want to engineer embryos but how far it should go.
By Brian Alexander

78 Crime Seen

Forensic science meets computer animation – in the courtroom. Crime-scene reconstruction will never be the same.
By Jacob Ward

110 Robots Go to War

The new mobile infantry is rolling out of the research lab and into harm's way. **By Michael Behar**

116 Wind Energy's Sea Change

The next wave of renewable power is bigger, cheaper, and multi-megawatts stronger than ever before. And it's about to go online in the North Sea. **By Alex Markels**

SPECIAL REPORT:

120 Long Bets

Danny Hillis vs. Nathan Myhrvold! Craig Mundie vs. Eric Schmidt! Seventeen of the world's most wired minds stake their names – and their cash – on the scientific truth.
PLUS: A brief history of betting on the future. **By Kevin Kelly**

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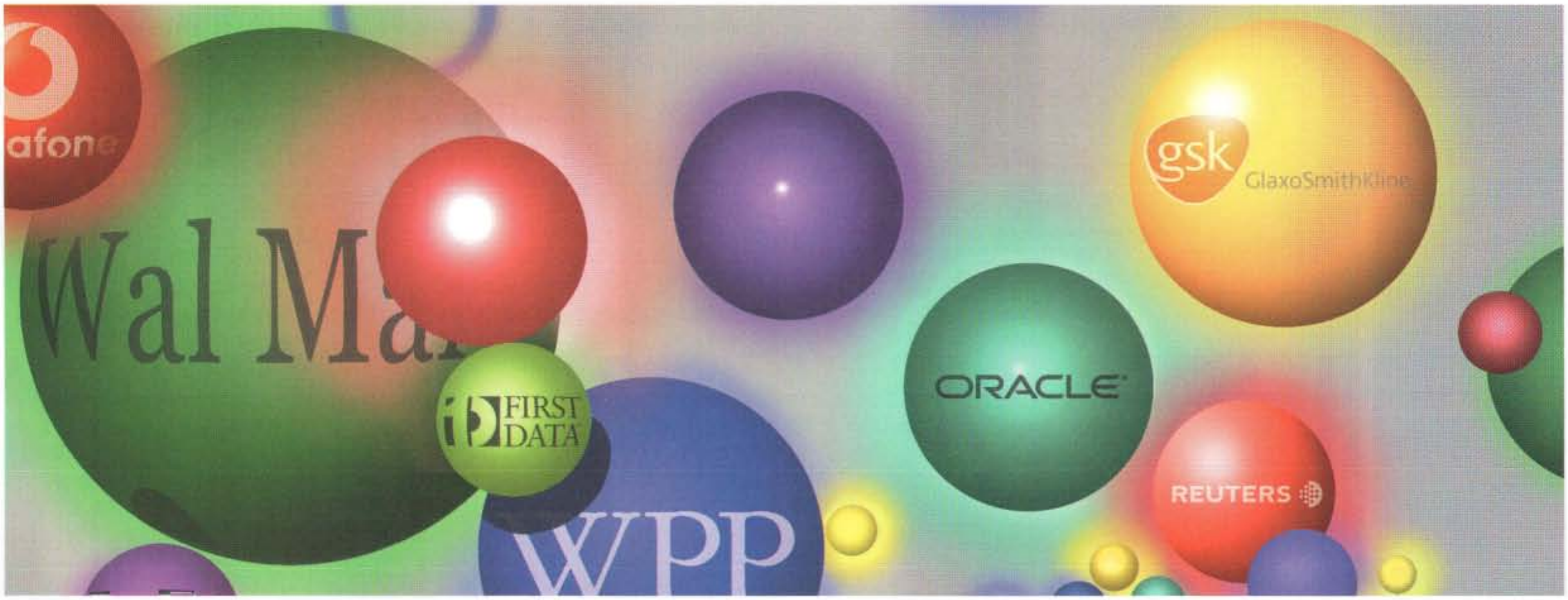

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May 2002 10.05

DEPARTMENTS

15 RANTS & RAVES Reader feedback.

21 ELECTRIC WORD Eye-popping.
Redefining your birthday suit, rethinking natural selection, reinventing the Green Goblin's ride in *Spider-Man* …

37 FETISH Technolust.
A world of firsts: a $5,000 bamboo bicycle, a hybrid car that looks just like a gas guzzler, hot swappable swim fins …

MUST READ

43 Blogging reaches critical mass

48 Milking cows for all they're worth

53 Lie detectors get inside your head

PLUS: People, Jargon Watch

61 CHANGE The wired economy.
The 3G auctions: last party of an old regime.

63 INFOPORN Raw data.
The onslaught of shareholder lawsuits,
plus why technology will put an end to overpopulation.

133 STREET CRED Consumer reviews.
Bill Gates assassinated on film, the most massive display of gaming memorabilia ever, James Gleick's trip through the '90s.
PLUS: Elvis Costello, Angélique Kidjo, and more …

141 BEST Great stuff – tested and approved.
Smartphones, digital photofinishing services, programmable robot kits.

148 FOUND Artifacts from the future.

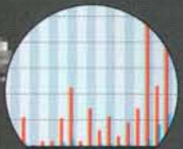
21

37

43

48

53


63

133

141

148

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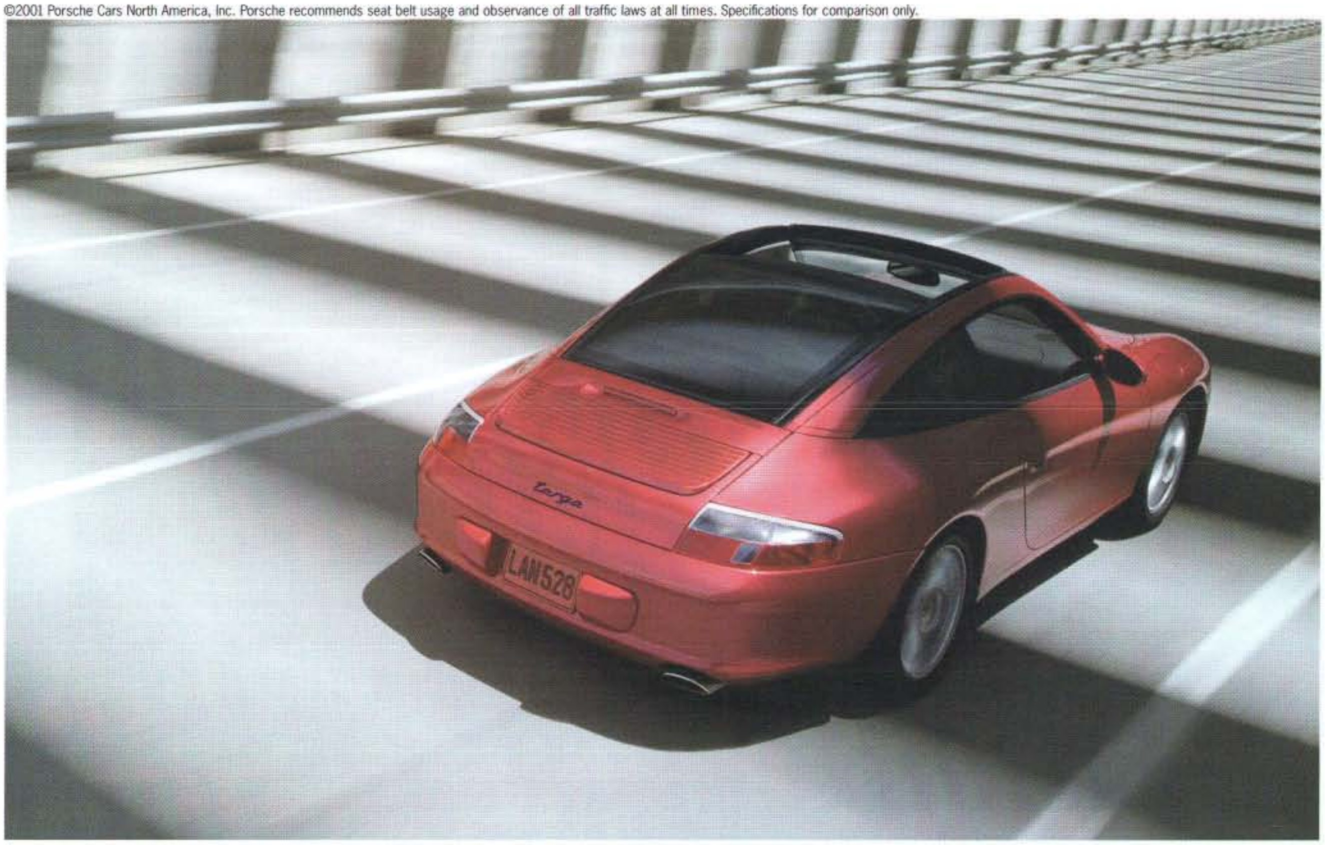

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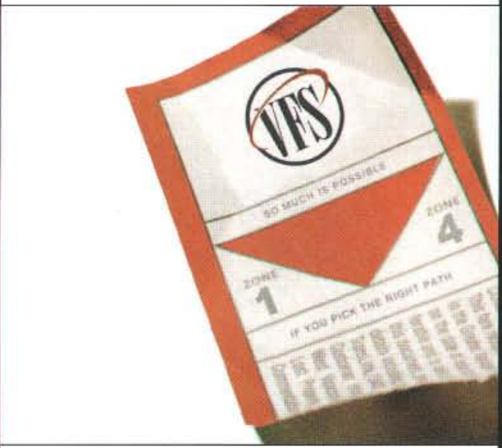

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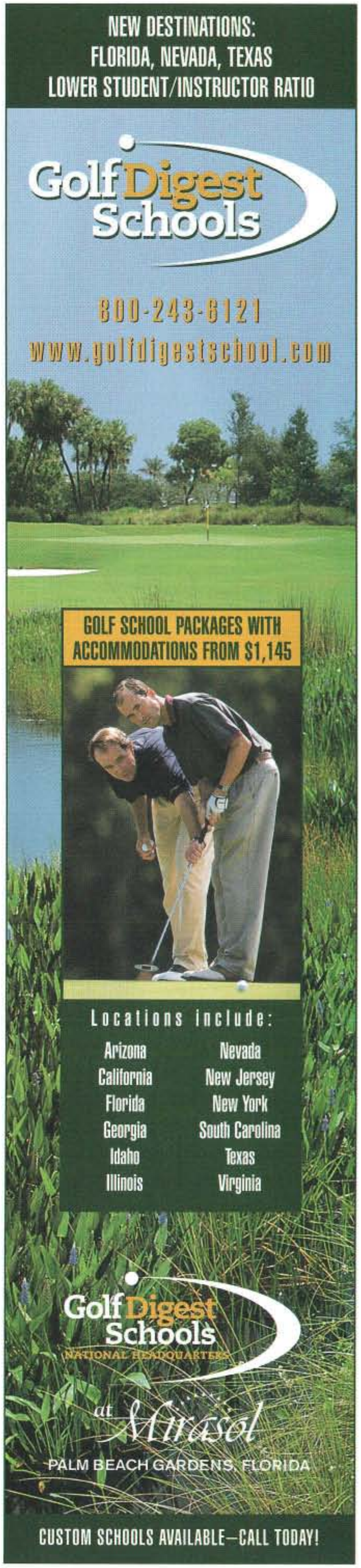

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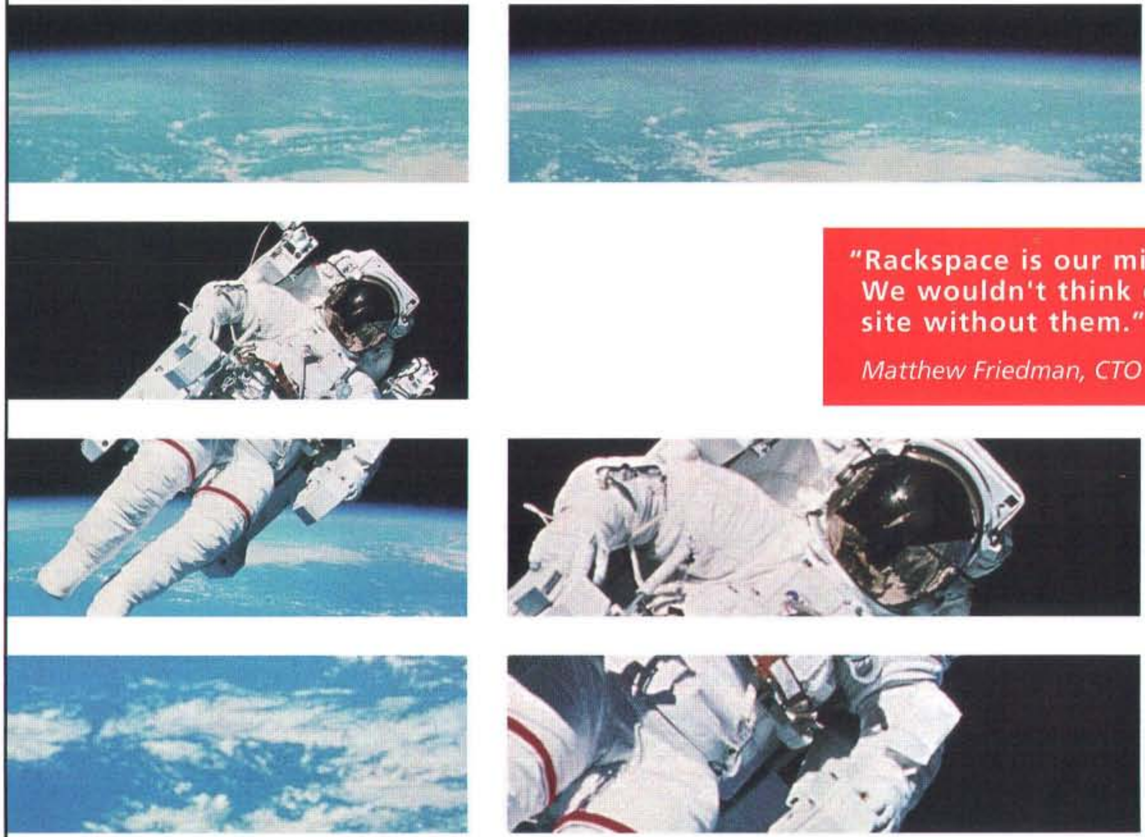

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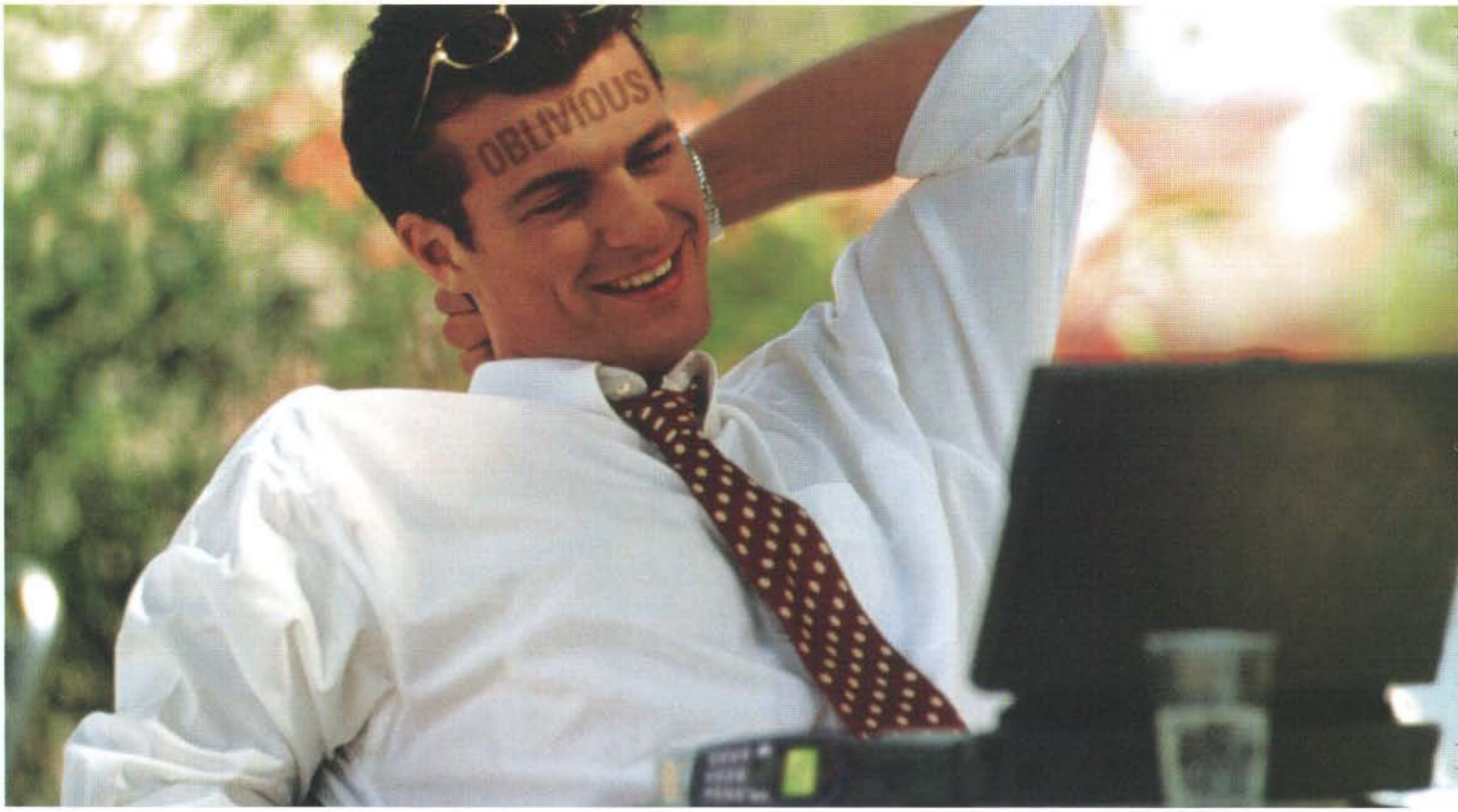

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"No.1,"
by Dave Morgan.

Small World

Discussions of globalization, whether in favor or against it, seem to always assume that big corporations such as Disney or McDonald's are the main drivers, forcing the American way of life onto cultures throughout the world ("The Ever-Expanding, Profit-Maximizing, Cultural-Imperialist, Wonderful World of Disney," *Wired* 10.02, page 70). People in those countries, however, willingly purchase products from them.

Globalization is a result of free humans independently pursuing their dreams and desires. There is no conspiracy. People simply value the products and ideas of other cultures, and they choose to incorporate them in their own lives.

David Musick
davidmusick7@hotmail.com

I find the February cover insensitive to veterans, especially US Marines. Six thousand Marines were killed on Iwo Jima over a 30-day period during World War II.

There was nothing funny about the flag raising. Replacing dead Marines with Mickey and Pluto is just in poor taste and shows poor judgment.

David Smith
Seattle, Washington

Return to Sender

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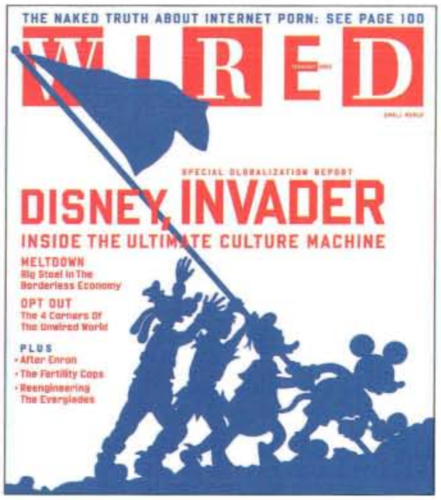
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Green Monster

While William McDonough, the "Prophet of Bloom" (*Wired* 10.02, page 60), is a strong proponent for the environment, Ford Motor Company is not. Yes, it's great that the multibillion-dollar multinational is making its River Rouge plant "green," but the rest of the company's actions are more about the green of money than the health of the planet.

Ford's green rhetoric is like a hood ornament: It may look pretty, but it does nothing for performance. The company can show it really cares about the planet by embracing the Kyoto Protocol to stop global warming, and by lobbying Congress and the White House to back the treaty. Another step Ford can take – invest a fraction of the billions it spends promoting gas-guzzling vehicles in fuel-cell technology or hybrid cars.

Gary Skulnik
gary.skulnik@wdc.greenpeace.org

Cell Division

Brendan I. Koerner's "Embryo Police" (*Wired* 10.02, page 52) contains an almost throwaway line that hides a guiding philosophy of genetic research and cloning: "a first step toward a *Gattaca*-like future of made-to-order babies, scrubbed clean of diseases and endowed with sparkly blue eyes."

The "and" too subtly divides two diametrically opposed motivations – "scrubbed clean of diseases" merits our unending focus and energy; "endowed with [fill in the blank]" warrants our strongest vigilance and consideration, if not our outright opposition.

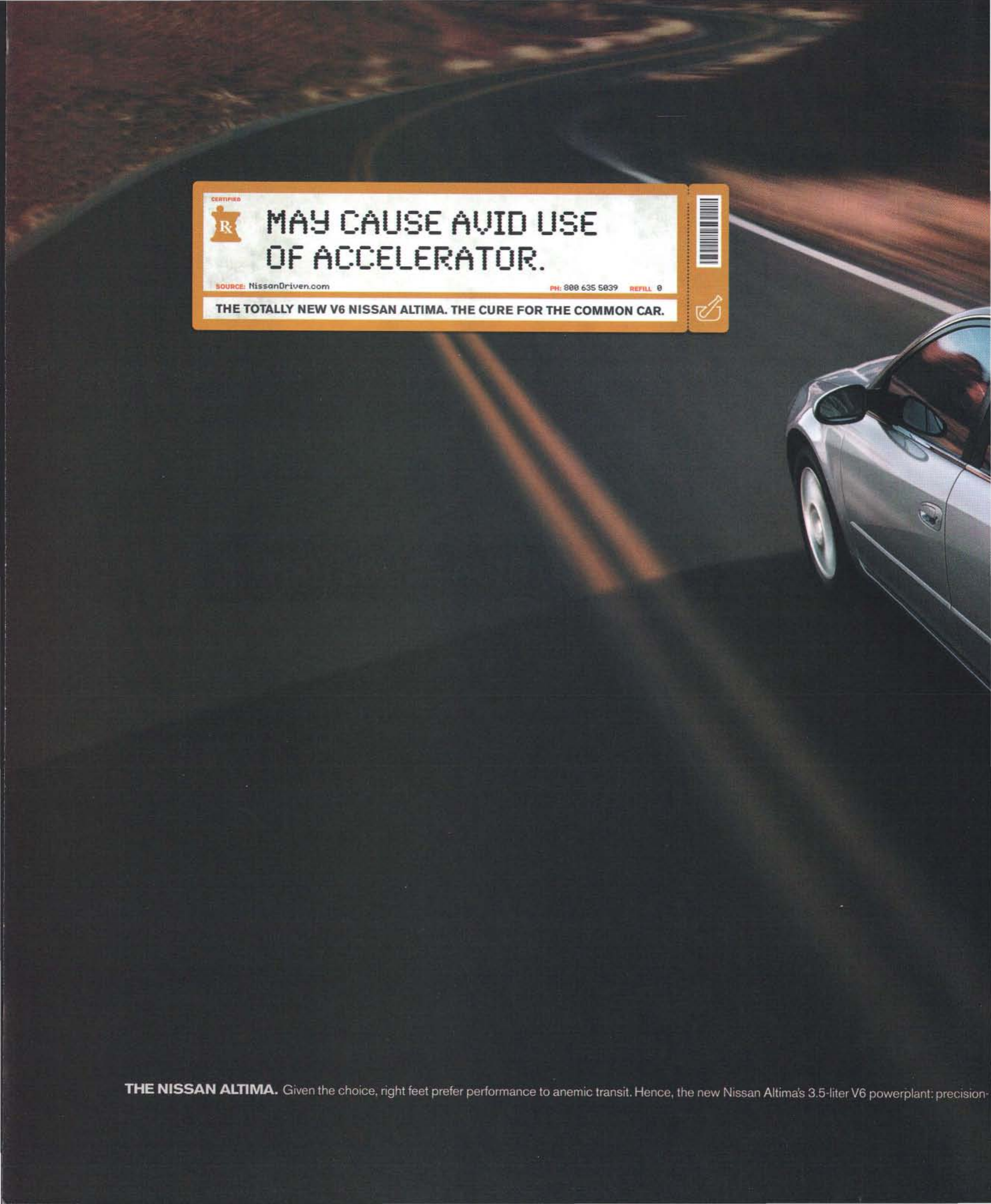
Jeff Dieffenbach
deepbrook@eudoramail.com

I read with interest your article on the technological advances taking place within the world of scientific procreation. If these discoveries can help eliminate certain hereditary diseases, we should all be enthusiastically supportive. However, I feel strongly that a voice from the other side is warranted here. As the parent of one biological child and three children adopted through US foster care, I would beg to differ with Alan Masterton in his quest to assure himself another daughter. With over a million daughters abandoned and waiting in China, he would do well to consider that perhaps his inability to replace Nicole is more about his choice than the decisions of the Human Fertilization and Embryology Authority.

Four biological sons should be enough for any couple, and tinkering with nature for personal gain should be seen as the arrogant self-indulgence it really is. With nearly 11 million orphaned children on this planet – children who are right here, right now, and not possibilities in some test tube – the Mastertons should go home, count their blessings, and teach their sons that having been born into a family that both wants them and cares for them is miracle enough.

Carole Klement Huxel
cakhuxel@mediaone.net

PHOTOGRAPH TOP: CRAIG MAXWELL; COVER ILLUSTRATION: JIM LUDTKE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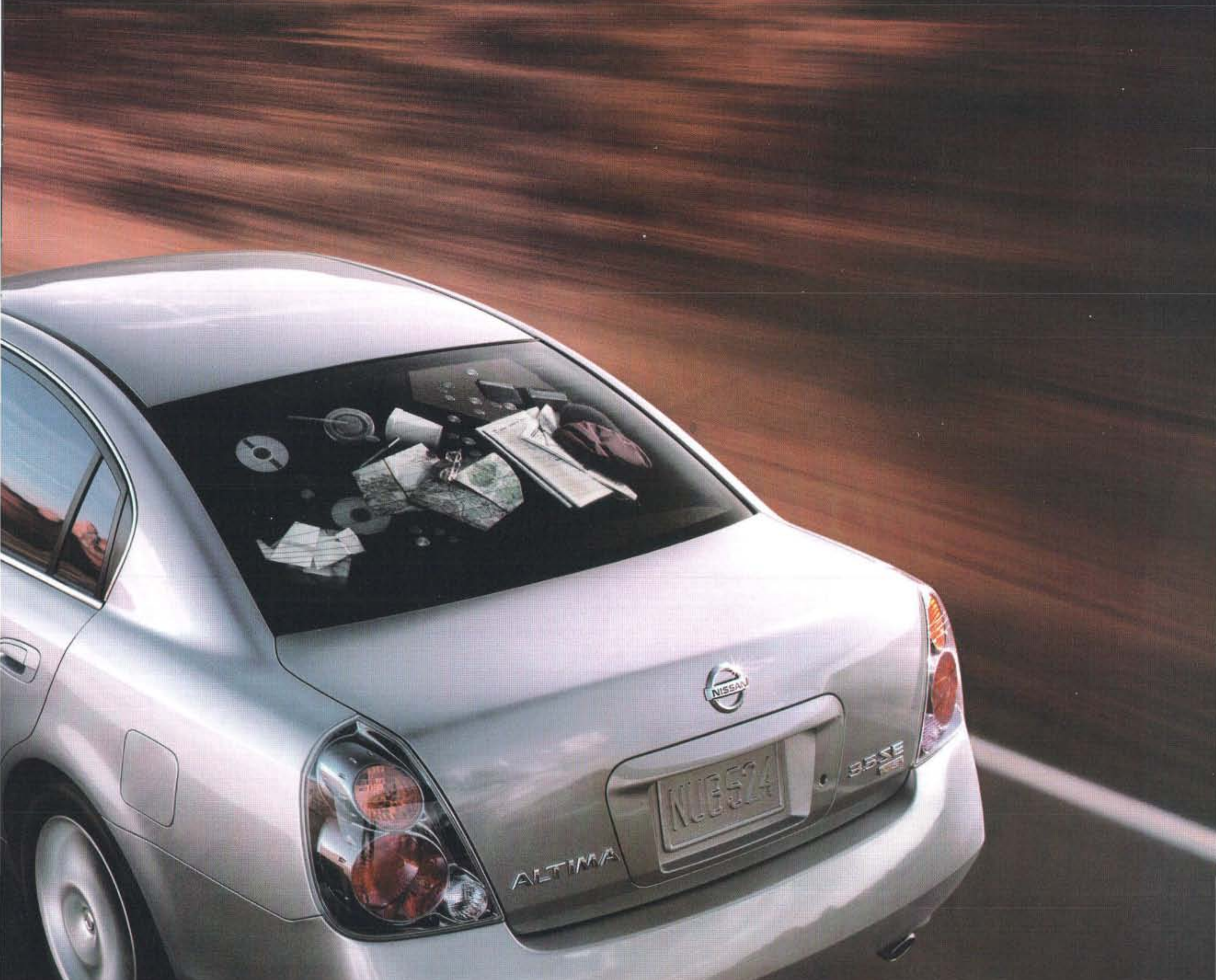

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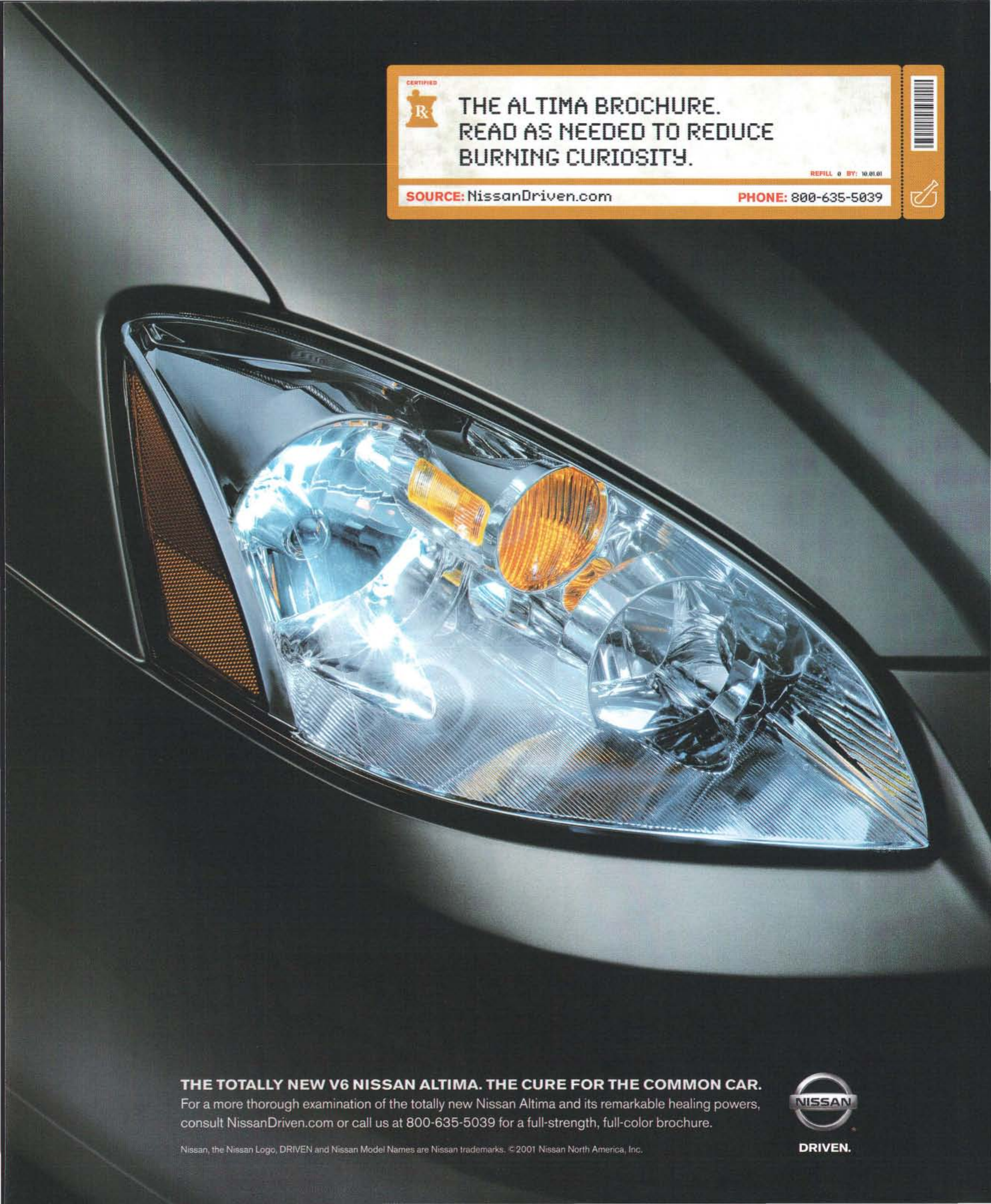

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RANTS & RAVES

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Careful, He Might Hear You

Give me the most sophisticated, advanced software ever used to "copyproof" CDs ("How a Copyproof CD Works," *Wired* 10.02, page 45). The simple act of purchasing a $2 cable from RadioShack will allow me to connect any sound-emitting device to any sound-recording device I want. Anything transmitted can be recorded. Pure copyproofing of music will happen only if you can sell a CD that can't be listened to.

Douglas Karr
dkarr@coders4hire.com

Undo

→ Fastest Finger: *Who Wants to Be a Millionaire* ("The Ever-Expanding, Profit-Maximizing, Cultural-Imperialist, Wonderful World of Disney," *Wired* 10.02, page 70) was originally a British program; the United States was originally a British colony.

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Government Tools

I just read "The Post-Enron Economy" (*Wired* 10.02, page 47) and agree that the problem presented by Enron is one the SEC can no longer safely ignore. As a regulatory body charged with monitoring investor protection and disclosure, the SEC must dramatically modernize the technology available to its enforcement efforts. Enron made mention of the limited partnership transactions in its filings with the commission, but the risks presented were extremely difficult to decipher and quantify, and their import was missed by the markets and the SEC.

A strong and proactive marrying of technology with regulatory disclosure oversight is needed. A new system must be designed – perhaps aided by the recent advent of XBRL (extensible business reporting language) – that would automate the screening of disclosure to catch questionable practices, taking into account past experiences with impropriety.

Rob Sobol
thesobolfamily@yahoo.com

I find it hypocritical that a magazine which has long spread the gospel of deregulation and privatization would lay the blame for the Enron mess at the feet of a government agency, namely the SEC. The irony is that, had the government been allowed to regulate and oversee as it should have, Enron would still be alive and intact today. It's a tragedy: Not only has this led to the loss of thousands of jobs and millions in investors' money, it has also severely damaged the image of the US in the global community. No serious investor anywhere will ever again think of the US financial system as well monitored.

Sam Childs
childs33@hotmail.com

Flush With Cash

Steven Kotler is wrong about the biology, engineering, economics, and politics of the struggle to protect the Everglades ("Reengineering the Everglades," *Wired* 10.02, page 104). Clinton and Gore talked about saving the wetlands – while making a deal that refused to enforce existing laws protecting the national park and state Everglades lands from damage caused by the sugar industry and state water managers. The agreement served to strengthen the sugar industry's control over the water flowing through South Florida's economy and environment, and turned the restoration plan into another massive and environmentally harmful pork-barrel engineering project.

In South Florida, disposing of urban and agricultural storm water during the wet season is as much a problem for the natural Everglades as finding dry-season water diverted by the sugar plantations. The aquifer program described in *Wired* as a key to the wetlands' recovery is actually designed to make taxpayers bear the cost of dealing with the sugar companies' polluted storm water. It's an engineering joke that would put underground drinking water supplies at risk.

As its critics predicted (and Gore's environmental supporters denied), the Comprehensive Everglades Restoration Plan submitted to Congress, by failing to specify that money and engineering design be devoted first to protection, is tilted more toward subsidizing new development in Florida than toward rebuilding biological integrity. Gore's broken Everglades promises helped Ralph Nader get the 96,000 Florida votes that made the contested chads and butterfly ballots relevant to the presidential election. Now even the environmental groups that cheered when Clinton and Gore gave the Army Corps of Engineers the specs for such a terrible "restoration" plan are beginning to warn that the $8 billion Everglades program is not based on sound science or good engineering and must be changed if one of Earth's great treasures is to be helped instead of harmed.

Joe Browder
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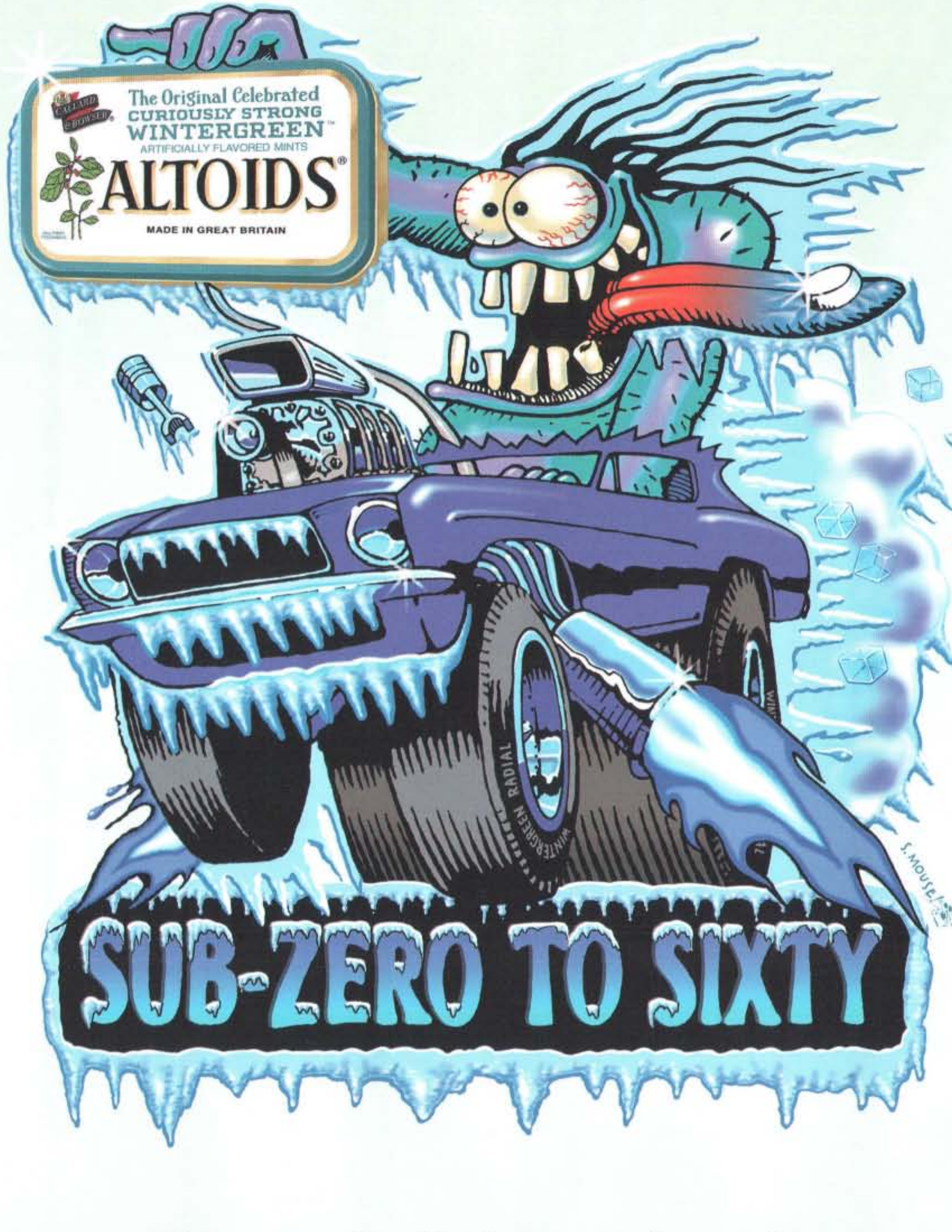

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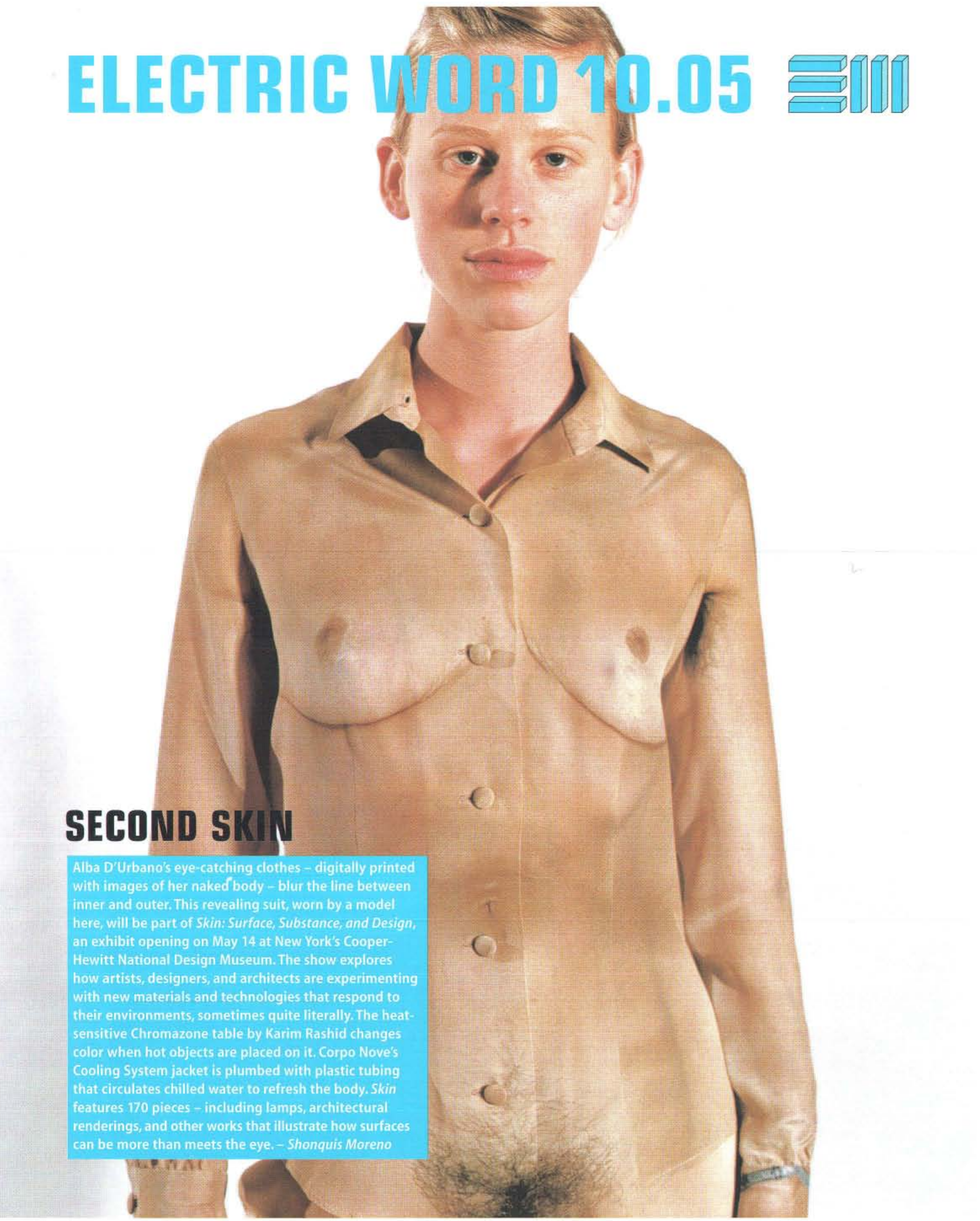
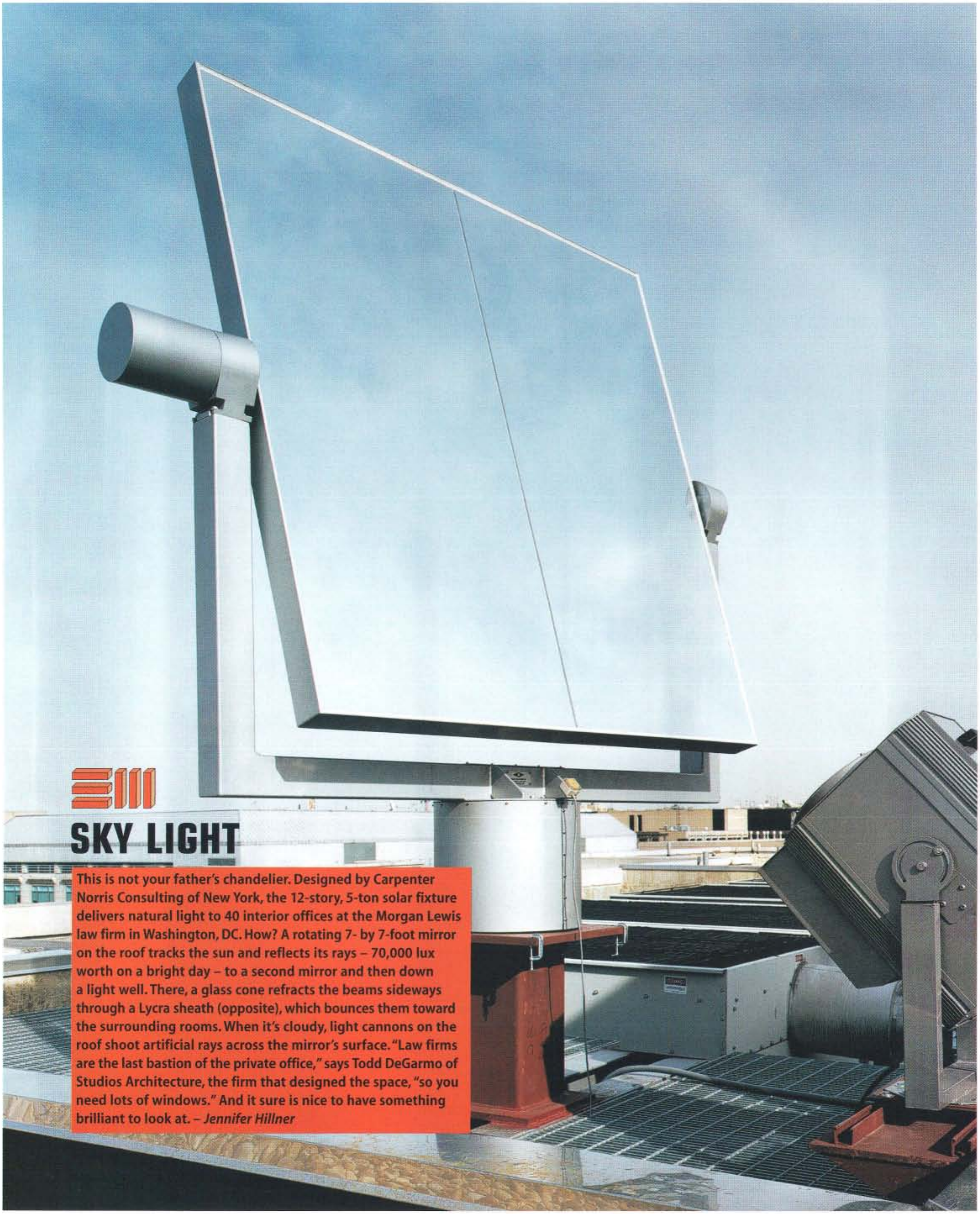


SECOND SKIN

Alba D'Urbano's eye-catching clothes – digitally printed with images of her naked body – blur the line between inner and outer. This revealing suit, worn by a model here, will be part of *Skin: Surface, Substance, and Design*, an exhibit opening on May 14 at New York's Cooper-Hewitt National Design Museum. The show explores how artists, designers, and architects are experimenting with new materials and technologies that respond to their environments, sometimes quite literally. The heat-sensitive Chromazone table by Karim Rashid changes color when hot objects are placed on it. Corpo Nove's Cooling System jacket is plumbed with plastic tubing that circulates chilled water to refresh the body. *Skin* features 170 pieces – including lamps, architectural renderings, and other works that illustrate how surfaces can be more than meets the eye. – *Shonquis Moreno*

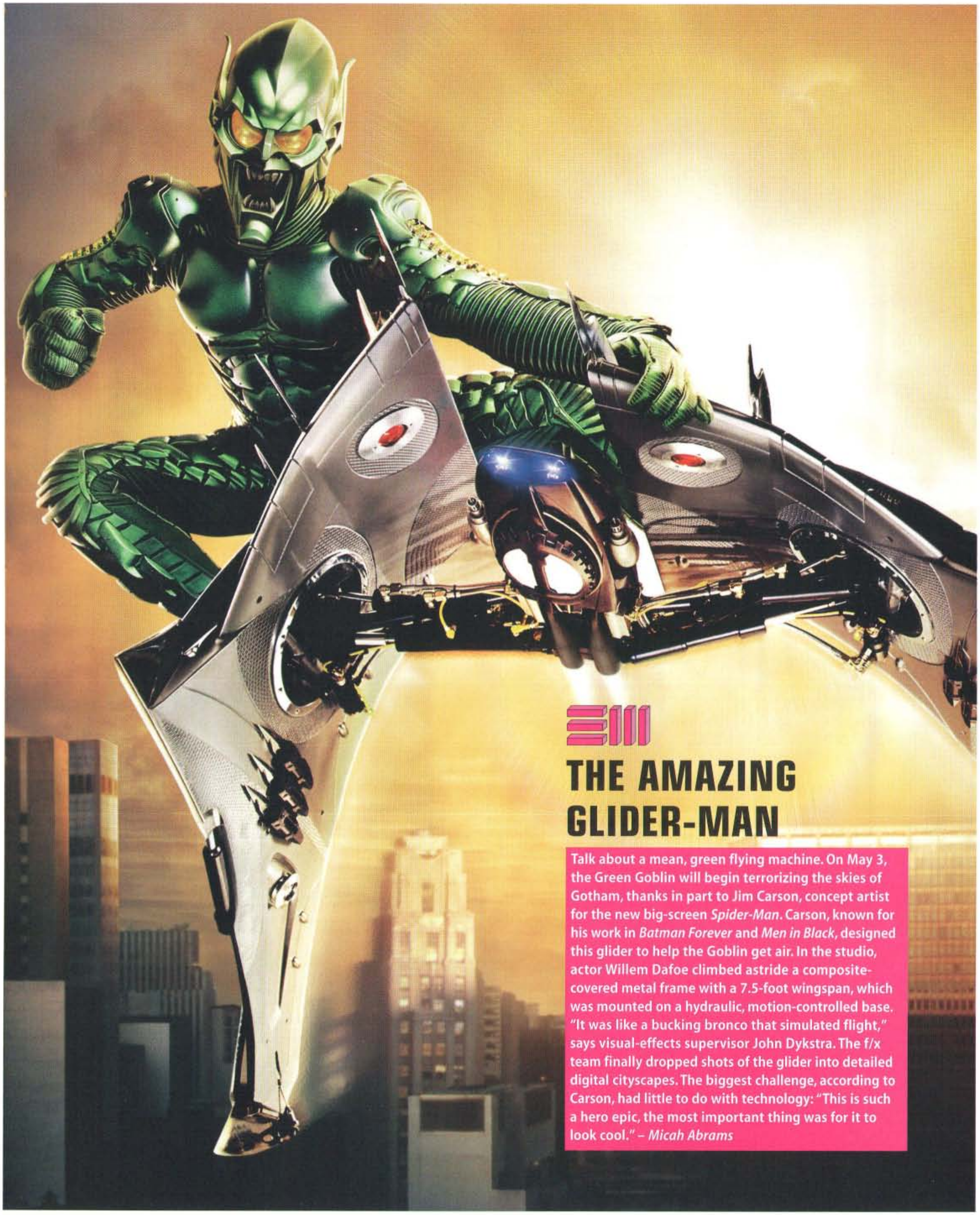
PHOTOGRAPH: MAGNUS WINTER



SKY LIGHT

This is not your father's chandelier. Designed by Carpenter Norris Consulting of New York, the 12-story, 5-ton solar fixture delivers natural light to 40 interior offices at the Morgan Lewis law firm in Washington, DC. How? A rotating 7- by 7-foot mirror on the roof tracks the sun and reflects its rays – 70,000 lux worth on a bright day – to a second mirror and then down a light well. There, a glass cone refracts the beams sideways through a Lycra sheath (opposite), which bounces them toward the surrounding rooms. When it's cloudy, light cannons on the roof shoot artificial rays across the mirror's surface. "Law firms are the last bastion of the private office," says Todd DeGarmo of Studios Architecture, the firm that designed the space, "so you need lots of windows." And it sure is nice to have something brilliant to look at. – *Jennifer Hillner*

PHOTOGRAPHS: RAIMUND KOCH



THE AMAZING GLIDER-MAN

Talk about a mean, green flying machine. On May 3, the Green Goblin will begin terrorizing the skies of Gotham, thanks in part to Jim Carson, concept artist for the new big-screen *Spider-Man*. Carson, known for his work in *Batman Forever* and *Men in Black*, designed this glider to help the Goblin get air. In the studio, actor Willem Dafoe climbed astride a composite-covered metal frame with a 7.5-foot wingspan, which was mounted on a hydraulic, motion-controlled base. "It was like a bucking bronco that simulated flight," says visual-effects supervisor John Dykstra. The f/x team finally dropped shots of the glider into detailed digital cityscapes. The biggest challenge, according to Carson, had little to do with technology: "This is such a hero epic, the most important thing was for it to look cool." – *Micah Abrams*

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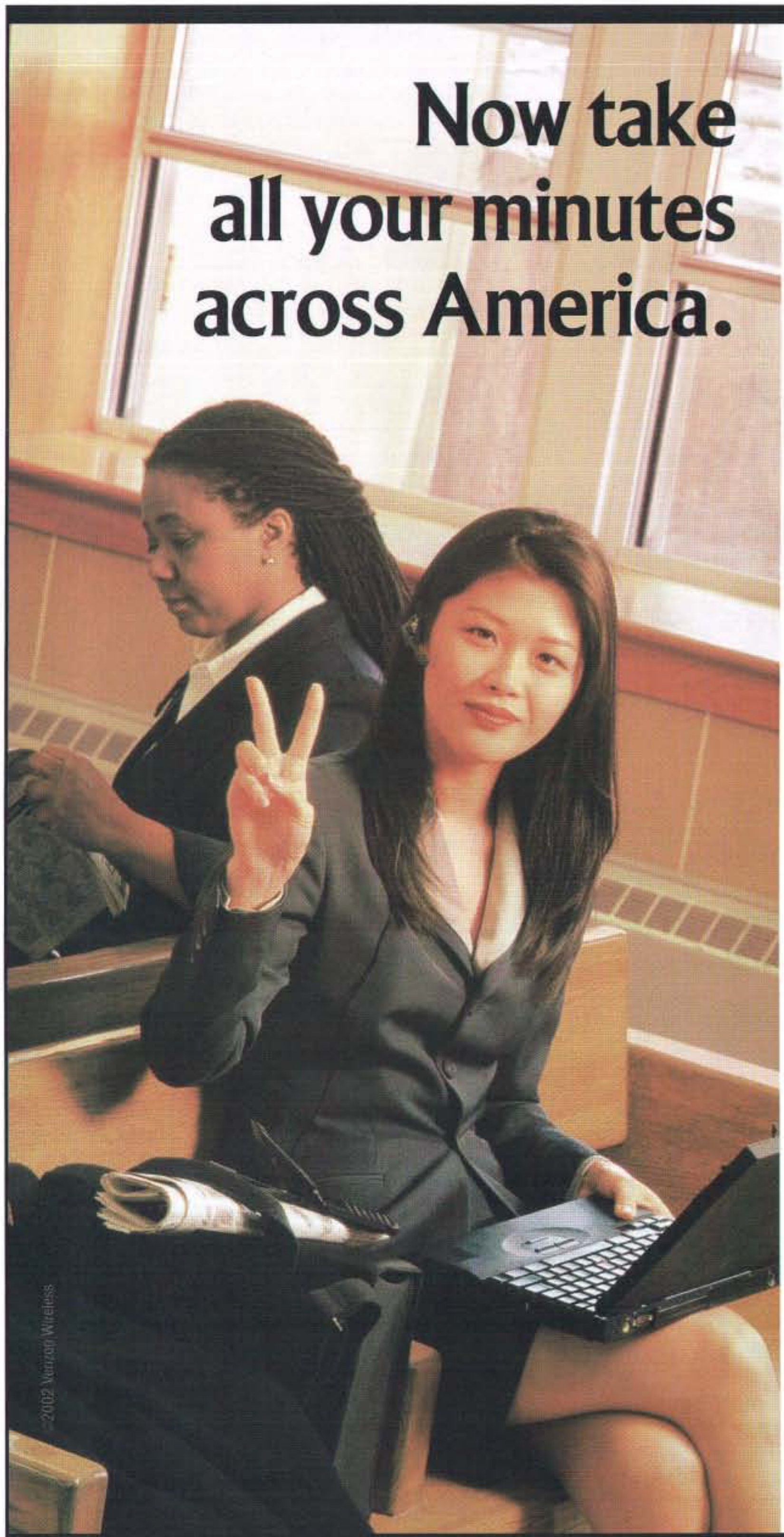
WIRED
WHAT'S NEXT

SHELF FUNGUS

"We'd simply run out of space," says Barbara Thiers, director of the William and Lynda Steere Herbarium, part of the New York Botanical Gardens. So, after a century of gathering and storing plant samples from around the world, the Herbarium is moving its collection in May. The nearly 7 million dried plants will be housed in a new $60 million facility, equipped with humidity, temperature, and light controls. A special cold room – the only one of its kind – will help preserve the gardens' 700,000 fungi specimens. And this time, there will be space for the 170 staff scientists to grow their efforts. – *Jessie Scanlon*

PHOTOGRAPH: ROE ETHRIDGE



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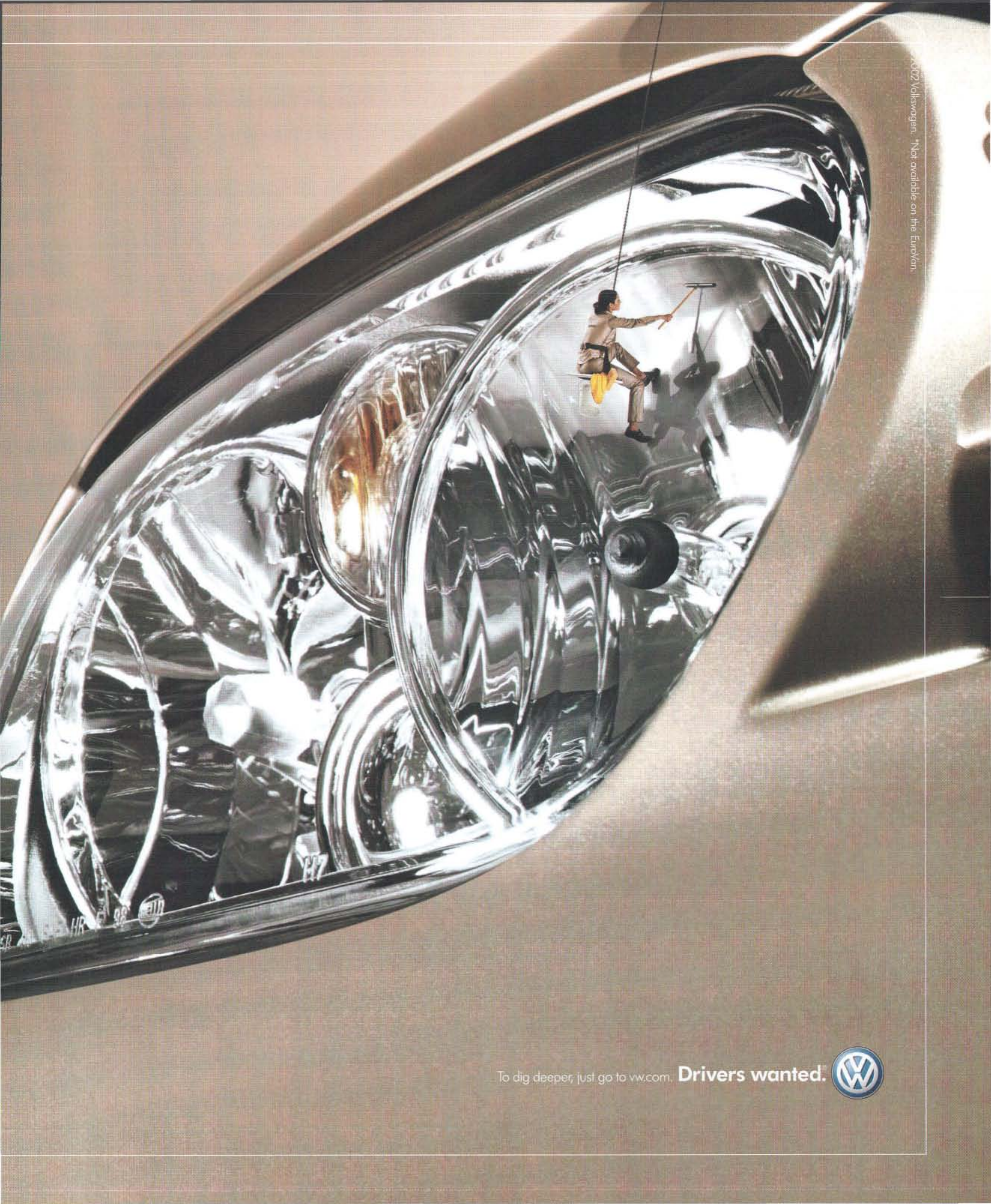
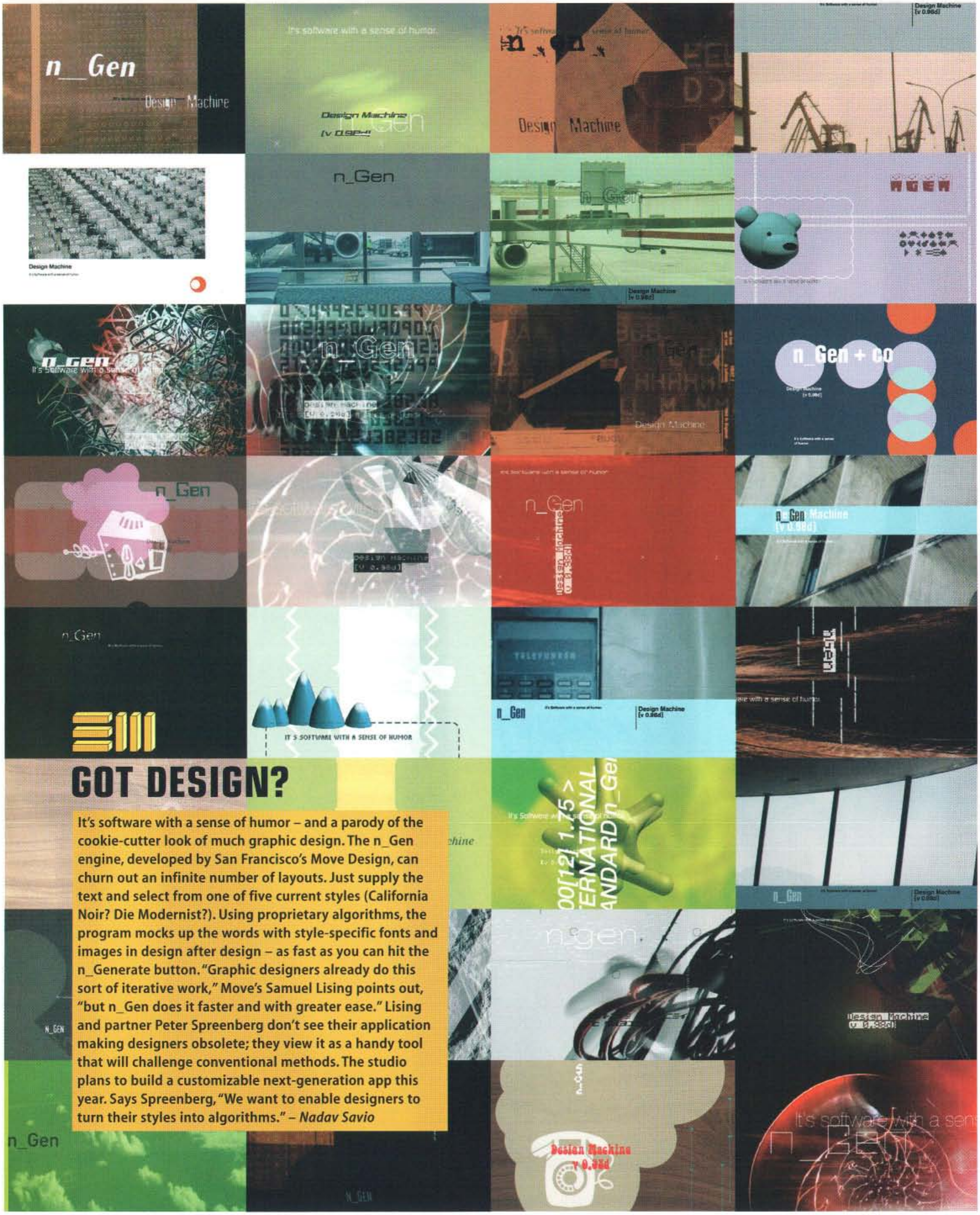
The little stuff is big to us. Check out our halogen headlights.* Kind of jewel-like aren't they? Well, these good looks are actually in the name of aerodynamics. Our designers figured that integrating all three light functions into one unit streamlines airflow. Pretty smart for a headlight, eh?



©2002 Volkswagen. *Not available on the EuroVan.



GOT DESIGN?

It's software with a sense of humor – and a parody of the cookie-cutter look of much graphic design. The n_Gen engine, developed by San Francisco's Move Design, can churn out an infinite number of layouts. Just supply the text and select from one of five current styles (California Noir? Die Modernist?). Using proprietary algorithms, the program mocks up the words with style-specific fonts and images in design after design – as fast as you can hit the n_Generate button. "Graphic designers already do this sort of iterative work," Move's Samuel Lising points out, "but n_Gen does it faster and with greater ease." Lising and partner Peter Spreenberg don't see their application making designers obsolete; they view it as a handy tool that will challenge conventional methods. The studio plans to build a customizable next-generation app this year. Says Spreenberg, "We want to enable designers to turn their styles into algorithms." – *Nadav Savio*

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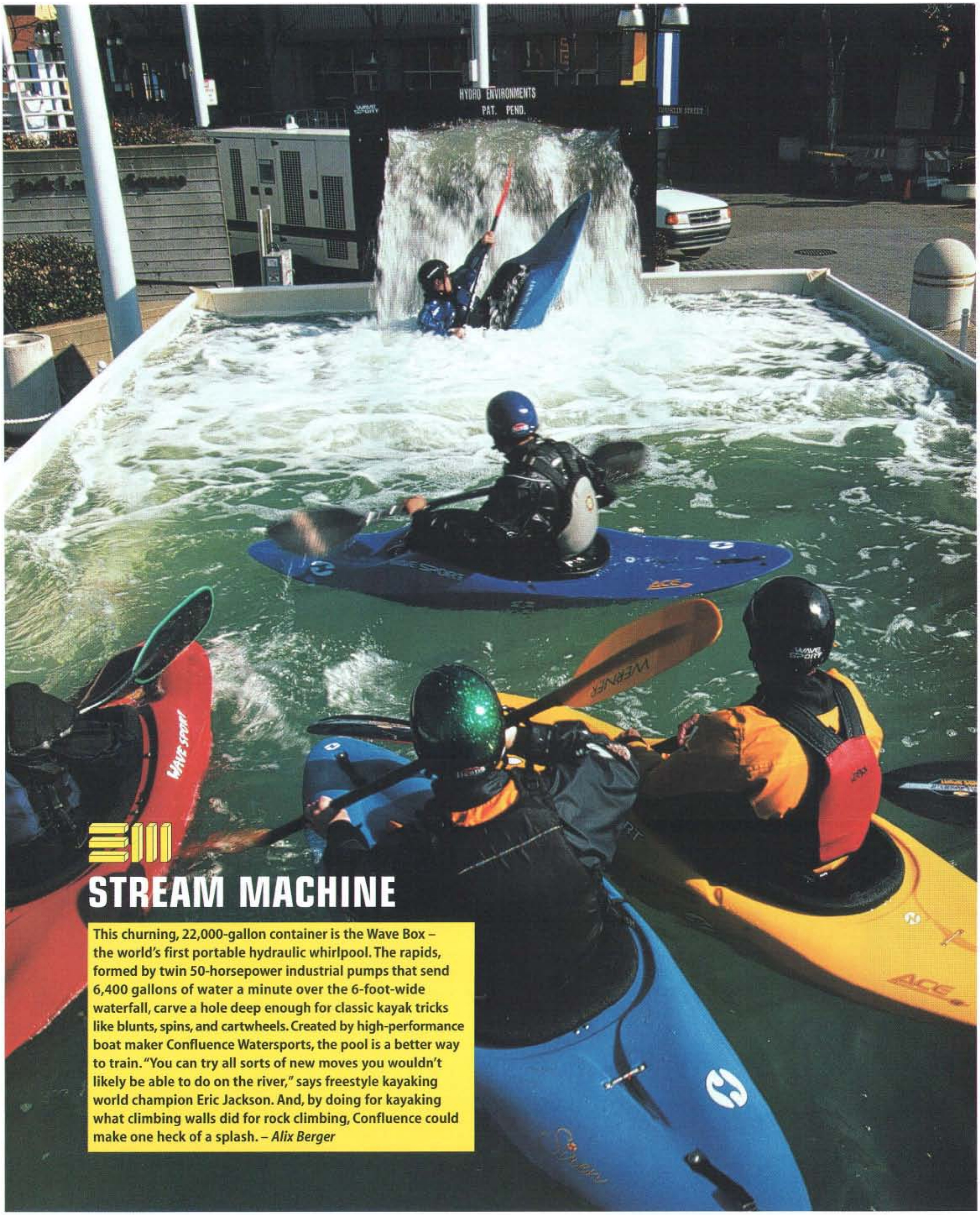

STREAM MACHINE

This churning, 22,000-gallon container is the Wave Box – the world's first portable hydraulic whirlpool. The rapids, formed by twin 50-horsepower industrial pumps that send 6,400 gallons of water a minute over the 6-foot-wide waterfall, carve a hole deep enough for classic kayak tricks like blunts, spins, and cartwheels. Created by high-performance boat maker Confluence Watersports, the pool is a better way to train. "You can try all sorts of new moves you wouldn't likely be able to do on the river," says freestyle kayaking world champion Eric Jackson. And, by doing for kayaking what climbing walls did for rock climbing, Confluence could make one heck of a splash. – *Alix Berger*

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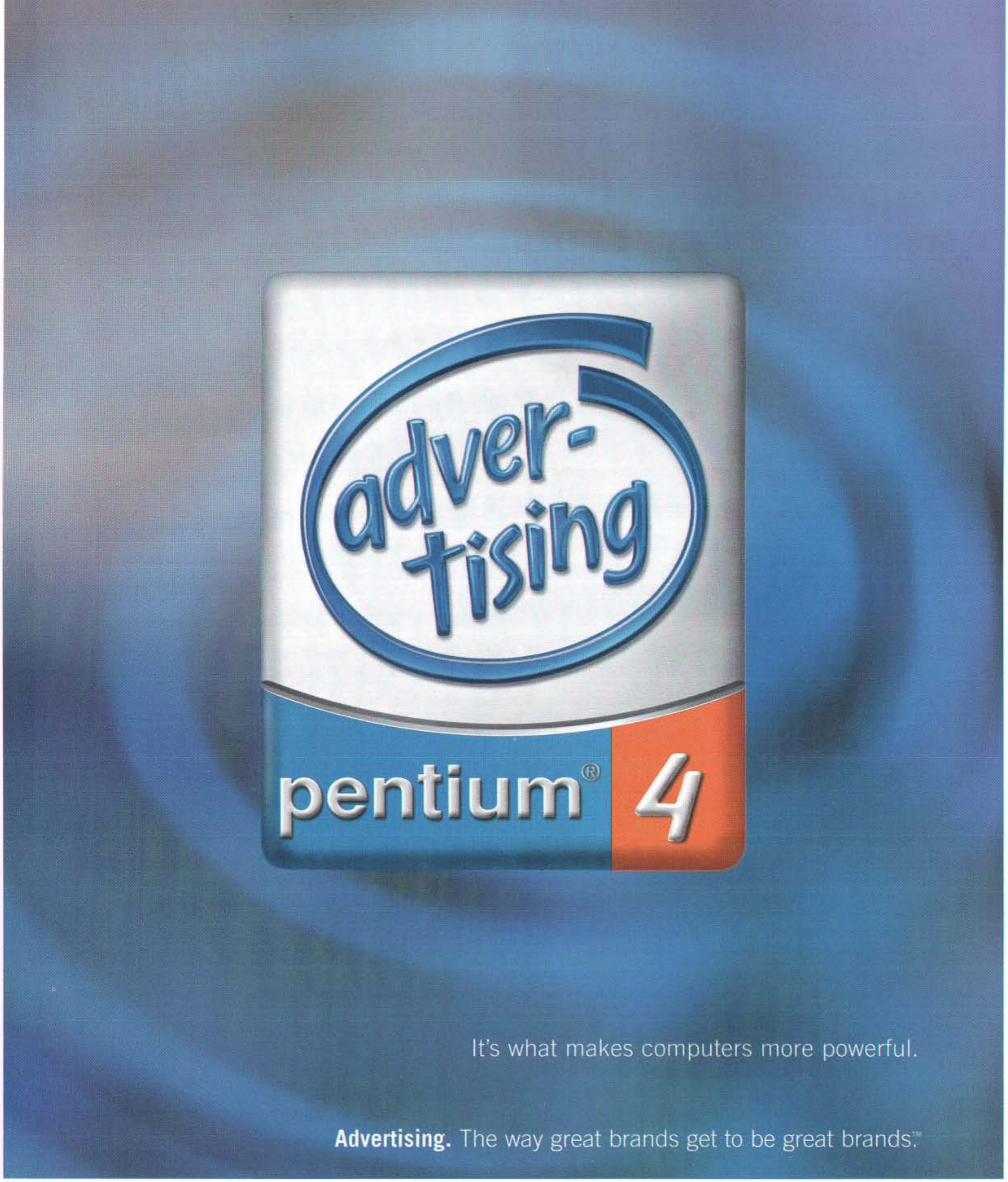
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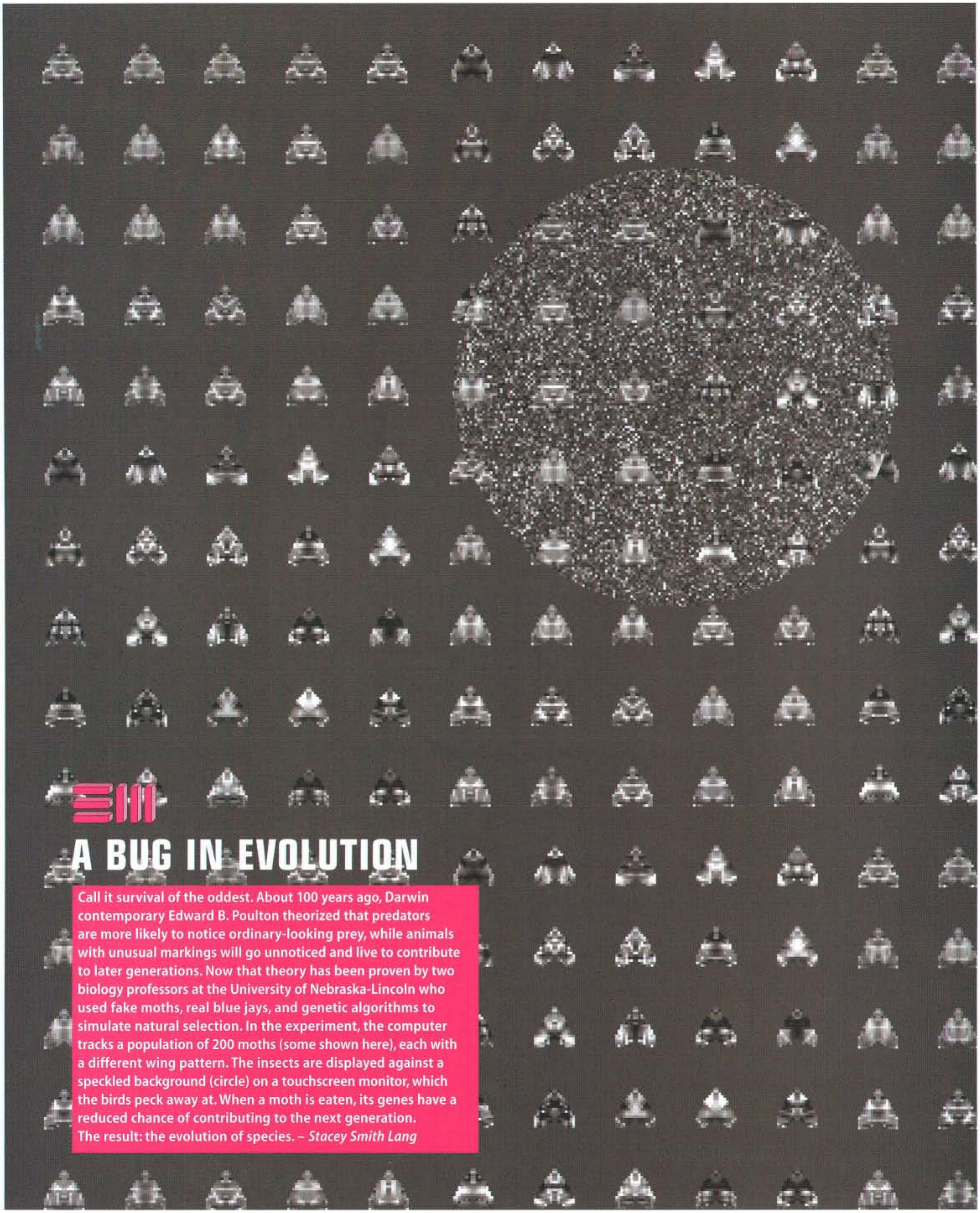

A BUG IN EVOLUTION

Call it survival of the oddest. About 100 years ago, Darwin contemporary Edward B. Poulton theorized that predators are more likely to notice ordinary-looking prey, while animals with unusual markings will go unnoticed and live to contribute to later generations. Now that theory has been proven by two biology professors at the University of Nebraska-Lincoln who used fake moths, real blue jays, and genetic algorithms to simulate natural selection. In the experiment, the computer tracks a population of 200 moths (some shown here), each with a different wing pattern. The insects are displayed against a speckled background (circle) on a touchscreen monitor, which the birds peck away at. When a moth is eaten, its genes have a reduced chance of contributing to the next generation. The result: the evolution of species. – *Stacey Smith Lang*

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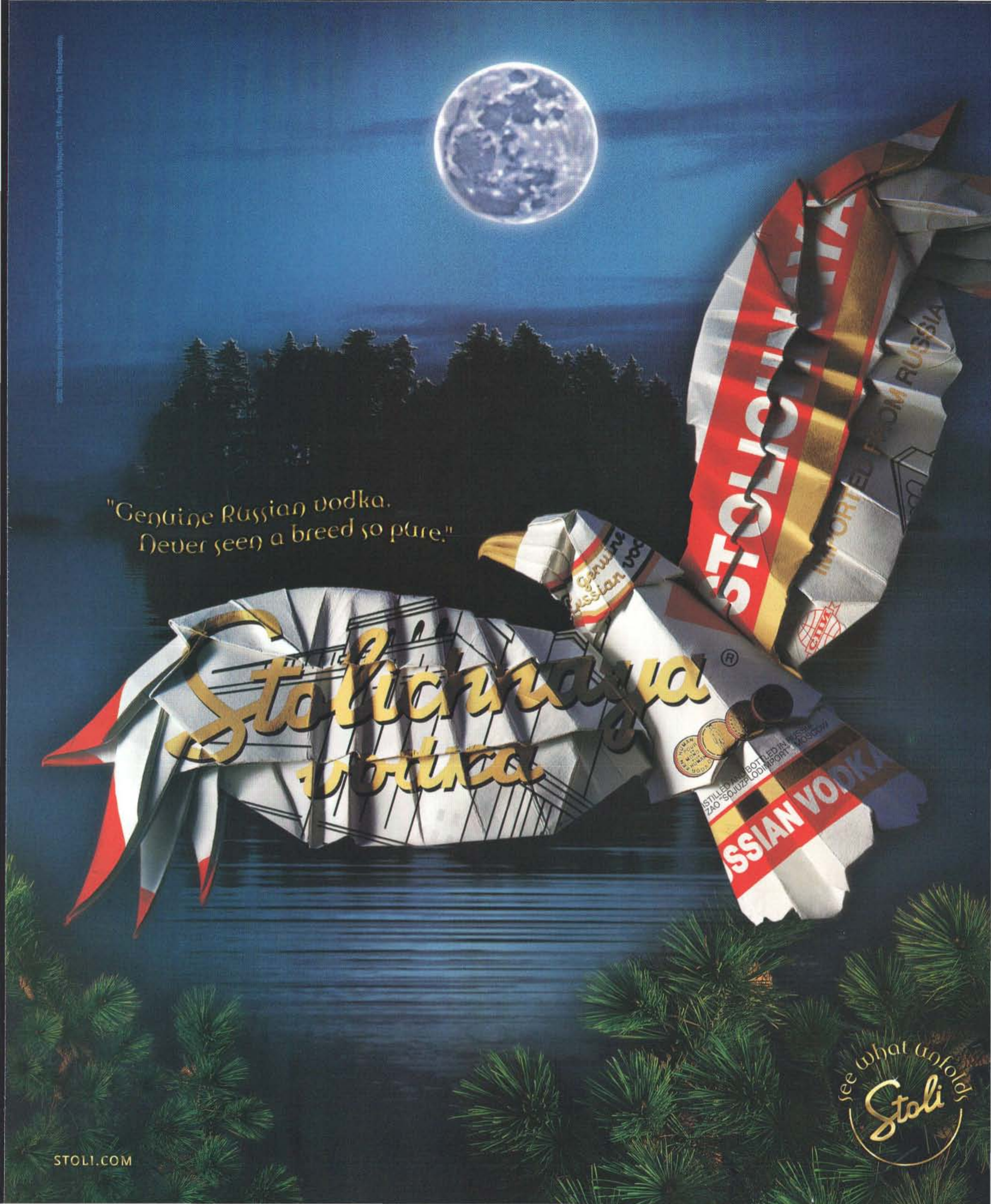
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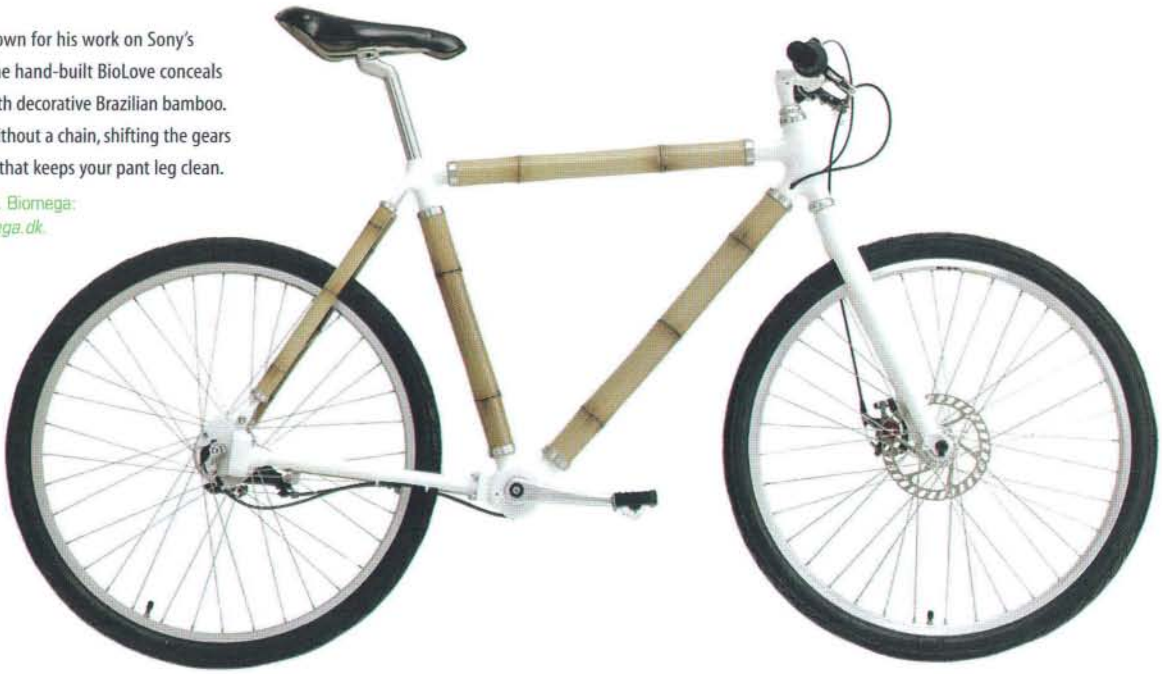
FETISH

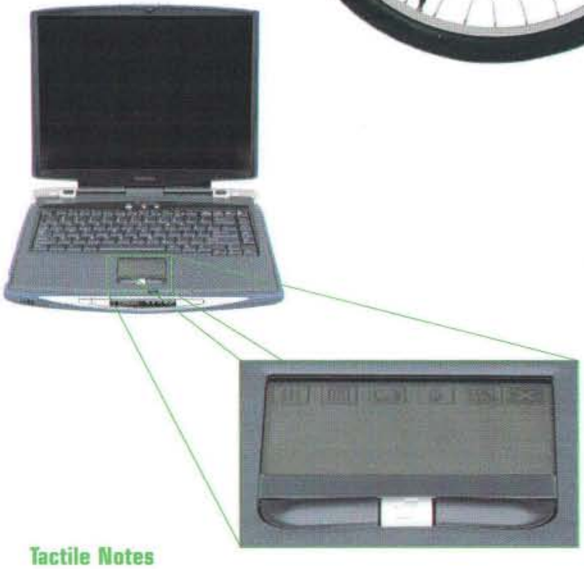
By Sonia Zjawinski

Love Without Chains

Designed by Ross Lovegrove, known for his work on Sony's Walkman and Apple's Newton, the hand-built BioLove conceals its 29-pound aluminum frame with decorative Brazilian bamboo. Its rotating shaft system works without a chain, shifting the gears within a neatly sealed, oiled unit that keeps your pant leg clean.

Limited Edition BioLove: $5,593. Biomega: +45 (70) 22 49 19, *www.biomega.dk*.





Tactile Notes

Toshiba's Satellite 5105-S607 is art smart in a way that many other computers are not. It's the first notebook to feature a built-in secondary display that's reminiscent of a PDA screen. The 2.4 x 1.6-inch touchscreen lets you write notes and draw simple illustrations with your fingers. Character recognition software is in development for saving your notes as text files.

Satellite 5105-S607: $2,399. Toshiba: (800) 867 4422, *www.toshiba.com*.

Small Developments

Panasonic's SV-AV10 shoots everything from lo-res stills to DVD-quality footage, yet remains small and light enough to roll up in your sleeve, Brando-style. The built-in flash sheds light on dark moments, and the 2-inch LCD lets you preview a day's worth of images. It even has an MP3 player and recorder. For instant gratification, pair the shooter with Panasonic's SV-P10 mobile printer (shown at right), and crank out wallet-sized color or black-and-white stills at 203 dpi.

SV-AV10: $450, SV-P10: $220. Panasonic: (800) 211 7262, *www.panasonic.com*.

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FETISH

Plugged In

Sure, Yamaha's SLG100N electric guitar can make plenty of noise, but only the person wearing the headphones will hear it. A digital signal processor reproduces the acoustics of any room, so you may forget you're playing for a solo crowd. Plug a portable audio player into the auxiliary port and strum along to your favorite instrumental. When you're finally ready for prime time, connect the guitar to your usual amp or dock with any computer to record.

SLG100N Silent Guitar, with earbuds: $699. Yamaha: +1 (714) 522 9011, *www.yamaha.com.*

Gum Not Included

Ditch the flimsy Topps of yesteryear for Smart Trading Cards, the celebrity dockets with a CPU chip. Each one highlights a pro skateboarder like Bob Burnquist or Bucky Lasek and gives important personal stats such as number of broken bones. Attach the primary reader to your PC, slide in a card, and you're automatically sent to StatCard's Web site when you're online. Learn more about the skater or play a *Tony Hawk*-style game (and save completed moves on the card). A pocket reader lets you share your virtual kick-flips with friends at the local skate park. The minireader's text ticker recounts your exploits move by move.

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Civic Hybrid, automatic or manual: $20,000. Honda: (800) 334 6632, *www.honda.com.*

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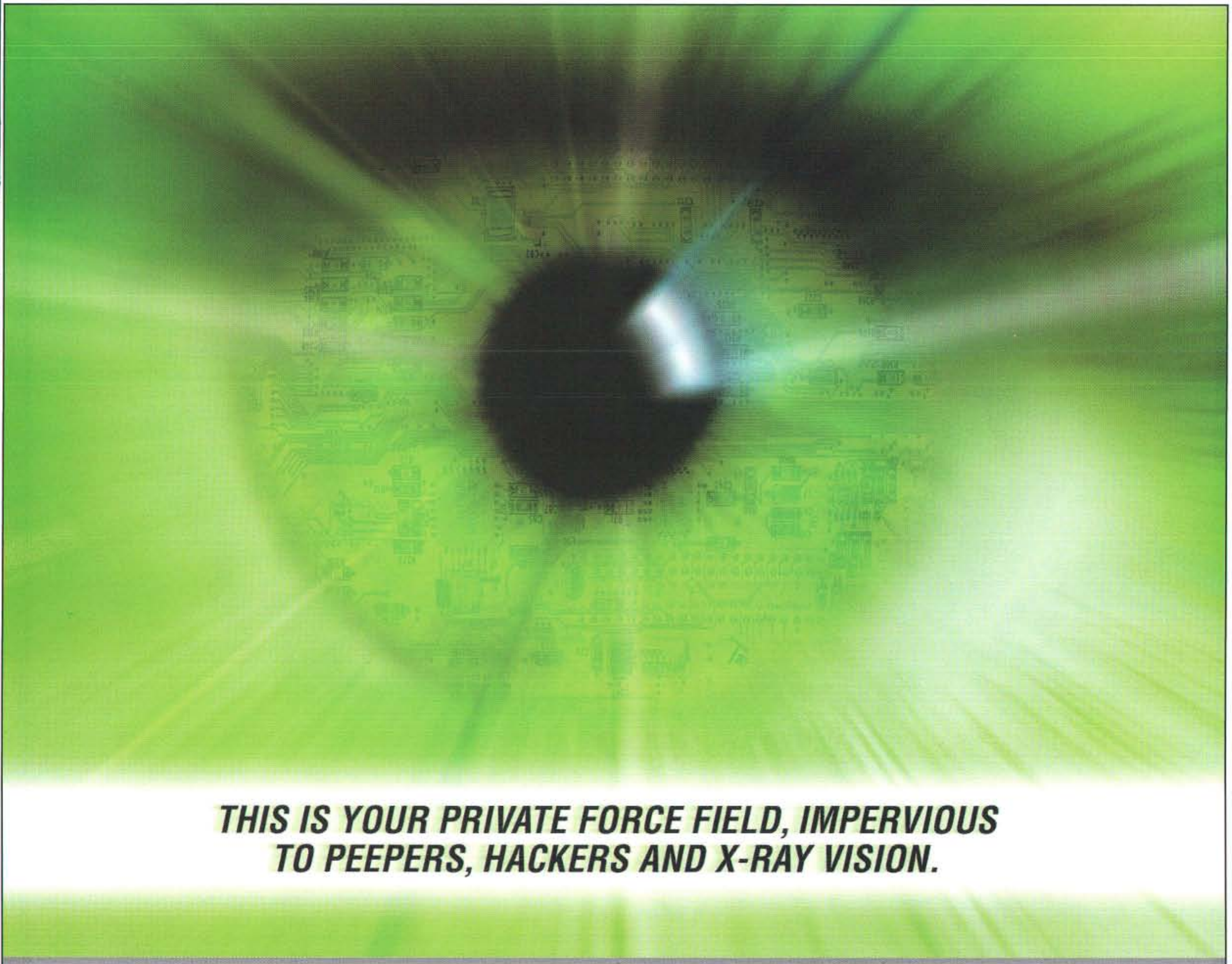

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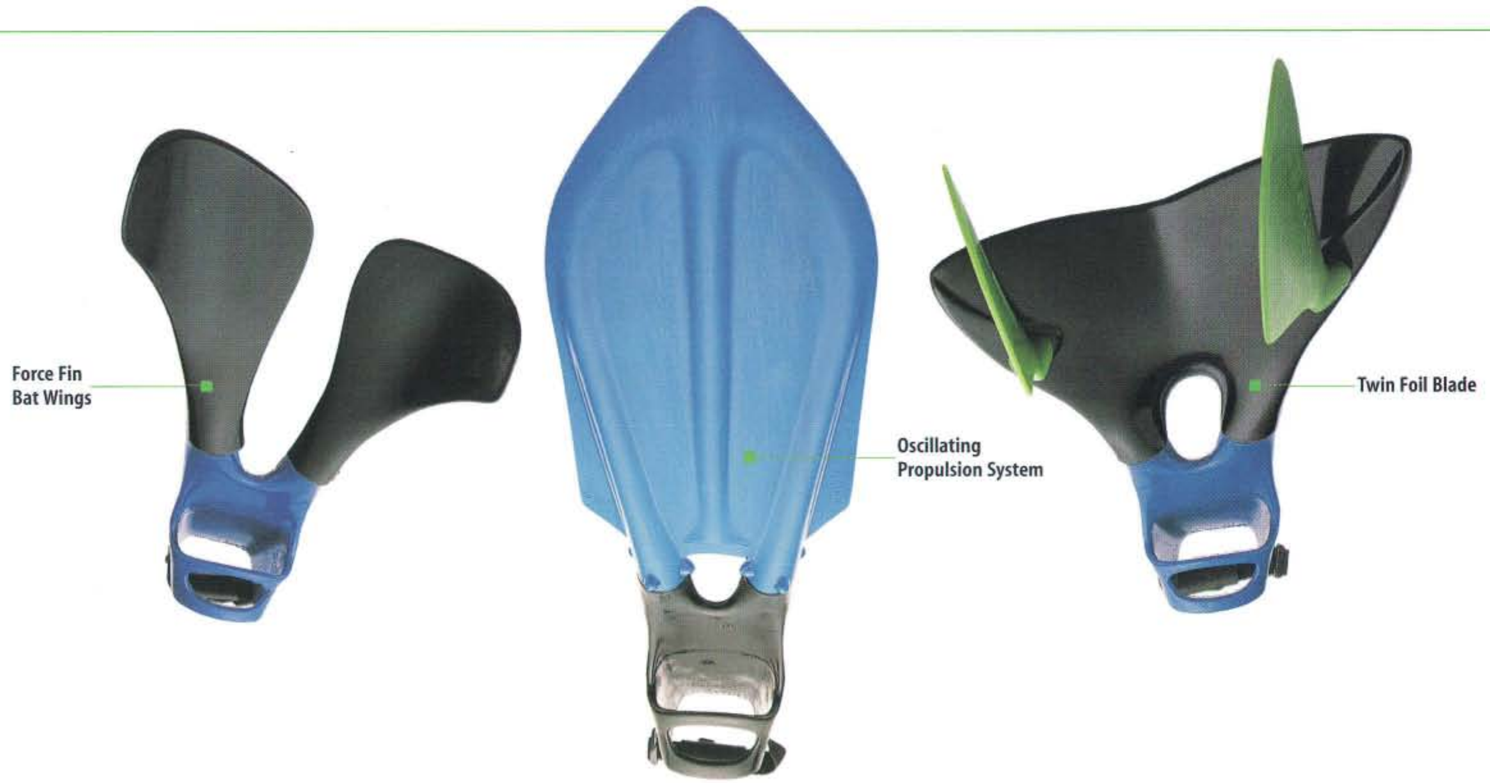

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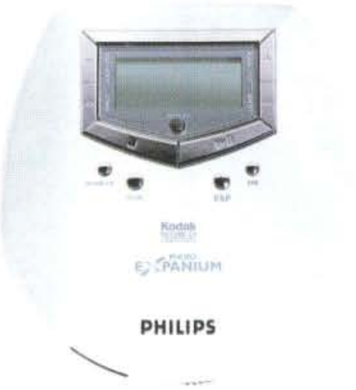
Launch Pad Foot Pockets: $125 a set. Blades: $125-$200 a pair. Force Fin: (800) 346 7946, *www.forcefin.com*.



Set-Top Snapshots

With Philips' eXp601, you no longer need a computer or a DVD player to show off pictures you've stored on photo CDs. The half-pound discman displays images from the likes of Kodak and CompuPic on a TV. Simply connect it to your telly with a video cable, and flip through volumes of snapshots with the included remote. When you're done boring – er, impressing – your friends, the unit doubles as a personal CD player.

eXp601: $199. Philips: (800) 531 0039, *www.philips.com*.

Evolution in Recording

DataPlay's yearlong promise of inexpensive, large-capacity storage cards finally becomes reality. Evolution's MTV EV 500DP does this by reading and writing data on 35-mm discs in a stamp-sized card housing. The catch? You can read over and over, but write only once. Yet at $5 or $10 a pop, they cost much less than CompactFlash and can store twice as much data. And who knows, the media could one day replace CDs: Major record labels, including Universal and BMG, plan to release albums on DataPlay cards by fall.

MTV EV 500DP: $370. Evolution: (866) 848 8070, *www.nowevolution.com*.

PHOTOGRAPHS CLOCKWISE FROM TOP: CRAIG MAXWELL, STYLING: JOHN MORTIMER/ARTIST UNTIED; MORTEN KETTEL; MORTEN KETTEL

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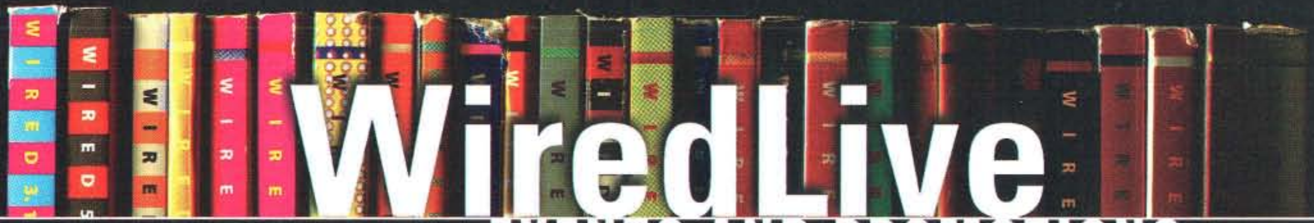

WiredLive

EVENTS AND PROMOTIONS

INFORUM, A Division of the Commonwealth Club presents

WIRED Icons

BETTING ON THE FUTURE: A WIRED ICONS EVENT

- **Will a digital actor win an Oscar by 2025?**
- **Will the US be tried and convicted of war crimes in The Hague by 2065?**
- **Will the first online undergraduate degree from an Ivy League school be granted by 2010?**
- **Will bioterror, or bioerror, lead to 1 million casualties in a single event by 2020?**

Envisioning the future is the first step toward shaping it. But how do you encourage responsible long-term thinking in a world obsessed with next quarter's earnings? Find out how and why the cofounders of the Long Bets Foundation are persuading the best minds of science, business, technology, and policymaking to stake their names and cash on their predictions for the future.

EVENT SPEAKERS

Stewart Brand
Cofounder: Long Bets Foundation,
The Long Now Foundation, Global Business Network,
Whole Earth Catalog

Kevin Kelly
Editor-at-Large, *WIRED*
Author, *New Rules for the New Economy*
Chairman, All Species Inventory

Chris Anderson, Editor-in-Chief, *WIRED*
Martha Baer, Senior Editor, *WIRED*

Wednesday, April 10, 2002
6:15 pm Reception
7:00 pm Discussion

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CAR TECH: A Special Automotive Report

Driving What's Next: An Industry in Motion

The architects of the automotive future are always in motion, reshaping the experience from the outside in. The focus is on innovation — getting today's mobile mavericks right where they want to be.

See Page 54 of this issue.

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Look Both Ways Before Crossing

The San Francisco chapter of the American Institute of Graphic Arts and The San Francisco Museum of Modern Art's Architecture + Design Forum present **Look Both Ways Before Crossing**, the 13th annual Design Lecture Series and the premier Bay Area lecture series of design. Join graphic designer Art Chantry on April 22, industrial designer, Ayse Birsel on May 6, advertising guru Jelly Helm on May 20, photographer and architectural historian Camilo Vergara on June 6 and graphic designer Charles Anderson on June 10. Lectures take place at the Yerba Buena Center for the Arts Theater in downtown San Francisco. Tickets are $20 per lecture and are available by calling 415.978.ARTS.

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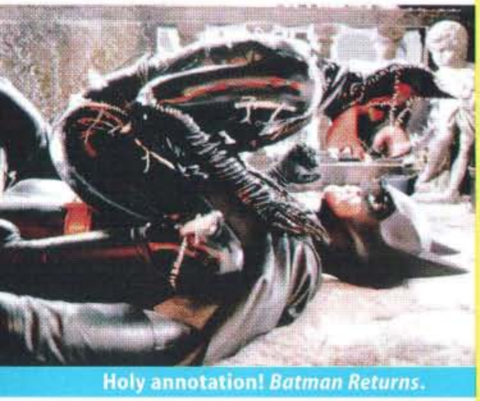
Everyone's a Critic

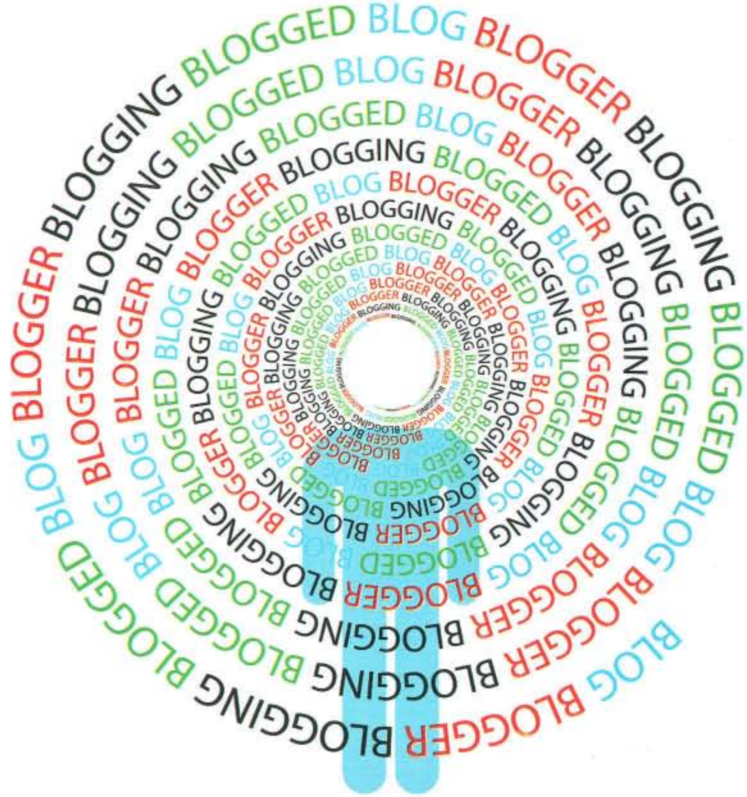
DVD COMMENTARY Think of it as MP3 meets *Mystery Science Theater 3000*. Obsessed fans – and critics – are recording their own audio tracks for DVD movies from *Attack of the Killer Tomatoes!* to *Batman Returns*. They blab about loving or loathing a film, point out trivia or errata, and poke fun at bad acting or direction. Recorded as low-bit-rate MP3s, these audio tracks can be played on a computer and easily synced up with a film by cuing to specific frames in the footage. The files are so small, commentators can easily share their work over the Net.

Mike Jackson, editor of DVDVerdict.com and webmaster of a site dedicated to offbeat director Tim Burton, is launching CommentaryArchive.com, a clearinghouse for wiseacres and would-be Eberts and Roepers. Don't expect the standard fare. "The quality of commentaries recorded by filmmakers and stars varies wildly," Jackson says. "When was the last time you heard one of them make fun of their own movie?" – *Pete Rojas*



Holy annotation! ***Batman Returns.***

STILL: WARNER BROS./MPTV.NET



The Blogging Revolution

By Andrew Sullivan

In the beginning – say 1994 – the phenomenon now called blogging was little more than the sometimes nutty, sometimes inspired writing of online diaries. These days, there are tech blogs and sex blogs and drug blogs and onanistic teenage blogs. But there are also news blogs and commentary blogs, sites packed with links and quips and ideas and arguments that only months ago were the near-monopoly of established news outlets. Poised between media, blogs can be as nuanced and well-sourced as traditional journalism, but they have the immediacy of talk radio. Amid it all, this much is clear: The phenomenon is real. Blogging is changing the media world and could, I think, foment a revolution in how journalism functions in our culture.

WANNA BET?
Dave Winer vs. NYT Digital's Martin Nisenholtz on blogs and the future of news
▸ see page 128

Blogs do two things that Web magazines like *Slate* and *Salon* simply cannot. First off, blogs are personal. Almost all of them are imbued with the temper of their writer. This personal touch is much more in tune with our current sensibility than were the opinionated magazines and newspapers of old. Readers increasingly doubt the authority of *The Washington Post* or *National* ▸

WEBLOGS ARE TO WORDS WHAT NAPSTER WAS TO MUSIC.

▸ *Review*, despite their grand-sounding titles and large staffs. They know that behind the curtain are fallible writers and editors who are no more inherently trustworthy than a lone blogger who has earned a reader's respect.

The second thing blogs do is – to invoke Marx – seize the means of production. It's hard to underestimate what a huge deal this is. For as long as journalism has existed, writers of whatever kind have had one route to readers: They needed an editor and a publisher. Even in the most benign scenario, this process subtly distorts journalism. You find yourself almost unconsciously writing to please a handful of people – the editors looking for a certain kind of story, the publishers seeking to push a particular venture, or the advertisers who influence the editors and owners. Blogging simply bypasses this ancient ritual.

Twenty-one months ago, I rashly decided to set up a Web page myself and used Blogger.com to publish some daily musings to a readership of a few hundred. Sure, I'm lucky to be an established writer in the first place. And I worked hard at the blog for months for free. But the upshot is that I'm now reaching almost a quarter million readers a month and making a profit. That kind of exposure rivals the audiences of traditional news and opinion magazines.

And I have plenty of company. The most obvious example is Glenn Reynolds, a hyperactive law professor who churns out dozens of posts a day and has quickly become a huge presence in opinion journalism. This is democratic journalism at its purest. Eventually, you can envision a world in which most successful writers will use this medium as a form of self-declared independence.

Think about it for a minute. Why not build an online presence with your daily musings and then sell your first book through print-on-demand technology direct from your Web site? Why should established writers go to newspapers and magazines to get an essay published, when they can simply write it themselves, convert it into a .pdf file, and charge a few bucks per download? Just as magazine and newspaper editors are slinking off into the sunset, so too might all the agents and editors and publishers in the book market.

This, at least, is the idea: a publishing revolution more profound than anything since the printing press. Blogger could be to words what Napster was to music – except this time, it'll really work. Check back in a couple of years to see whether this is yet another concept that online reality has had the temerity to destroy.

Andrew Sullivan writes for www.andrewsullivan.com, The New Republic, *and* The New York Times.

Power Bloggers

MIT's Blogdex tracks top blogs based on how many people link to them. Recent picks: Blogger guru Evan Williams and *Star Trek: TNG* idol Wil Wheaton. Here are five other diarists to look for. – *Chris Baker*

Jessamyn West Hippest ex-librarian on the Web (*librarian.net*).
WHAT'S COOL: Brings the controversy and intrigue of library subculture to life. Plus: Naked librarian etchings.
COMMENTS TO LINKS: 1:5

Adam Curry Ex-MTV veejay, wealthy Internet entrepreneur (*live.curry.com*).
WHAT'S COOL: The formerly mousse-dependent host dishes dirt and gossip on his halcyon days at MTV. Take that, Richard Marx!
COMMENTS TO LINKS: 4:1

Josh Marshall DC journalist (*talkingpointsmemo.com*).
WHAT'S COOL: Delivers an insightful, frequently funny peek behind the power-journalism curtain. One recurring feature: the Ari Fleischer Ridiculous Misstatement Watch.
COMMENTS TO LINKS: 1:1

Jeffrey Zeldman Web guru and author of *Taking Your Talent to the Web* (*zeldman.com*).
WHAT'S COOL: His *Daily Report* offers consistently helpful tips, links, insights, and resources that are free of jargon and techno-snobbery.
COMMENTS TO LINKS: 1:4

Claire Robertson Australian illustrator and Web designer (*loobylu.com*).
WHAT'S COOL: Serves up breezy diary accompanied by exquisite illustrations. Bonus: an insider's look at Melbourne's house-hunting scene.
COMMENTS TO LINKS: 20:1

In a Theater Far, Far Away ...

DIGITAL PROJECTION When he began shooting *Star Wars Episode II* in an all-digital format, George Lucas imagined that *Attack of the Clones* could screen in 2,000 digital-projection theaters nationwide. Oh, well. As of the May 16 opening, only 19 screens had the equipment required to do so. Here's where to find them. – *Chris Baker*

Harkins Arrowhead Cinemas 18
Peoria, Arizona

AMC Media Center 6
Burbank, California

Edwards Irvine Spectrum 21 Megaplex
Irvine, California

El Capitan Theatre
Los Angeles, California

Loews Century Plaza
Los Angeles, California

AMC Mission Valley 20
San Diego, California

AMC 1000 Van Ness
San Francisco, California

AMC Pleasure Island 24
Lake Buena Vista, Florida

AMC South Barrington 30
South Barrington, Illinois

AMC Studio 30
Olathe, Kansas

General Cinema Framingham 16
Framingham, Massachusetts

Show Case Cinemas Randolph
Randolph, Massachusetts

Edgewater Multiplex Cinemas
Edgewater, New Jersey

AMC Empire 25 Theatres
New York, New York

Clearview Ziegfeld Theatre
New York, New York

Loews Cineplex E-Walk
New York, New York

Cinemark at Valley View
Valley View, Ohio

Showcase Cinemas Springdale
Springdale, Ohio

Cinemark at Legacy
Plano, Texas

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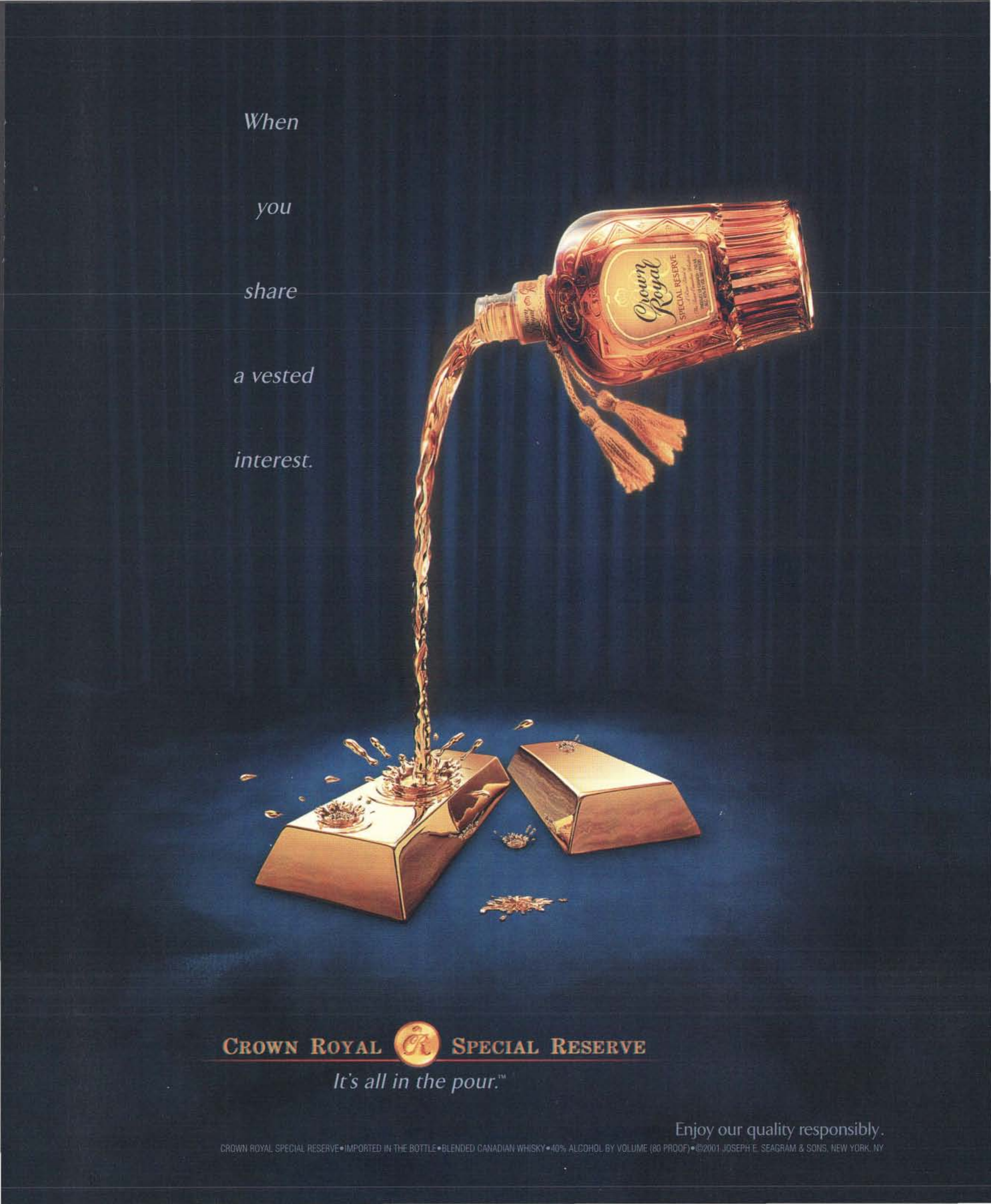
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Digital devotion: a Sunday techno-service at Lovers Lane in Dallas.

Lights, Camera, Religion

MULTIMEDIA Holy water be damned. The 11:45 am Sunday service at the 5,000-member Lovers Lane United Methodist Church in Dallas delivers a total immersion experience: five huge television screens, three sound systems, Broadway lights. "It actually personalizes the service," says pastor Stan Copeland. "You can see the preacher's eyes water if he's telling a story that touches his heart."

Lumicon, a Dallas video and digital production company, makes such razzle-dazzle devotion possible for the humblest church mouse. Costs range from $300 to $2,000 a year (plus another $10,000 to $15,000 for hardware). About 135 churches, including Lovers Lane, have subscribed to the weekly resource of computer graphics, videos, music, and film clips. Thousands more are inquiring. Now if they could just come up with a mute button for off-key choirs. – *Sara Solovitch*

Crossover Artists

VIDEOGAME SOUNDTRACKS Pumping bass, shrieking violins, ambient techno. Movie soundtracks set a mood. So do videogame scores. No wonder name musicians are being brought in on big games. Trent Reznor, Mixmaster Mike, and others relive the experience. – *Clare Kleinedler*

Musician / Game	The sound is …	As a kid, I was obsessed with …	If I were a game character, I'd be …	This game is …
Trent Reznor of Nine Inch Nails / *Quake*	Unnerving, unsettling, ominous, anxious.	*Tempest* and *Robotron 2084* (and I still am).	Hmm. Nothing comes to mind.	A classic that still holds up. There's something raw and unfriendly about it. It has an edge that many of today's more finished games lack.
Kevin Haskins & Doug DeAngelis of Messy / *Devastation*	Dark and ambient.	Kevin: *Pong* Doug: *Sinistar.*	Kevin: Excellent pro golfer. Doug: Same here.	A fluidly futuristic flight through a city into some type of mothership. We shaped the style of the music to the flowing motion of the game.
Chris Vrenna of Tweaker / *American McGee's Alice*	Dark, tense, antique, as played by an insane child's orchestra.	Mattel electronic football, a portable game with tiny red LEDs for players.	The star of a first-person shooter like *Duke Nukem*. I'd have all those crazy weapons and just destroy the enemy.	Beautiful and true to Lewis Carroll's era; some of the most surreal design I've seen, plus puzzles and old-school touches rarely found.
Reeves Gabrels, a David Bowie collaborator / *Omikron*	From ambient electronic to Middle Eastern electronic; strip club to futuristic spaghetti Western.	Oddly, it was *Asteroids*.	I am pretty happy to have appeared as myself in *Omikron*. That's plenty.	Cinematic and cutting-edge. That really appealed to me from my experience with writing music for film.
Mixmaster Mike / *SSX 1, SSX 2, Jet Grind Radio*	*SSX 1*: funky, psychedelic *SSX 2*: spaced-out funk *Jet Grind Radio*: bobsled in outer space.	*Defender*. For its time, it was insanely action-packed.	Bruce Lee. He always gets to kick ass.	Super dope. All three games have endless options and capabilities, loads of stages, and rounds that can keep you busy forever.

PHOTOGRAPHS FROM TOP: KATRIN THOMAS; KEVIN WESTENBERG/NOTHING RECORDS; TROY RASEY; ROXANN ARWEN MILLS; JOHN SOARES; PAUL RAY

The ABC's of Safety: Air bags. Buckle up. Children in back. *At maximum output.

ENGINEERED TO BE ALMOST PSYCHIC.

Introducing a car so technologically advanced, it can sense trouble and begin to adjust for it before the driver even notices that there's a problem. It's the 6-cylinder 212-horsepower Outback VDC from Subaru. The VDC stands for Vehicle Dynamics Control, a highly intelligent stability system that rivals those found in vehicles costing thousands more.

Using a sophisticated series of sensors, VDC can help prevent loss of control due to oversteer, understeer, wheel spin or vehicle drift. The instant a difference is detected between the driver's intended direction of travel and the path the car is actually taking, VDC takes corrective action. Momentary brake pressure may be applied to individual wheels. The All-Wheel Drive system may redistribute the amount of power between the wheels. Even the engine's output may be momentarily reduced. Before the driver even realizes that loss of control is impending, any or all of these measures may be applied automatically to help restore directional stability. It's almost as if the car has a sixth sense.

In fact, in every sense the Outback VDC is a remarkable vehicle. It even features a state-of-the-art 200-watt* sound system built exclusively for Subaru by McIntosh®. With 11 speakers placed in 7 strategic locations, the audio quality has been specifically tuned to the car's unique acoustics.

The Outback VDC from Subaru. Truly a phenomenon in the world of automotive engineering. To find out more, visit us at **www.subaru.com**.

SUBARU
The Beauty of All-Wheel Drive.

BFD

Death to Barcodes

Vivek Subramanian wants to rid the world of barcodes. And no, he's not a conspiracy theorist. The UC Berkeley engineering professor and others in the field of organic semiconducting want to revolutionize retailing by replacing UPCs with smart, dirt-cheap printed circuits.

Envision the UPC-free supermarket of 2012: You wheel your cart through what looks like a metal detector. Your tab is instantly calculated and displayed on a screen. You confirm the charges to your account, grab your receipt, and roll. The grocer saves on labor, you save time, and manufacturers track goods at every step. "We can reduce inventory and take cash out of the system," says Larry Kellam, Procter & Gamble's supply-chain guru.

The underlying technology – radio frequency identification – is already widely employed. Antitheft devices in clothing stores use RFID, as do those windshield-mounted transponders that let commuters sail through toll plazas. The process is simple: A tag reader emits radio waves, setting up an electromagnetic field. A passive transponder – say, a chip on the back of a cereal box – draws enough power from the RF signal to spit back a hard-coded ID number. The reader decodes the reply, checks the store database, and registers "Wheaties, 16 oz., $3.49." Unlike barcodes, RFID tags can be read accurately from a distance and while in motion.

Tagger: Subramanian and his organic inkjet.

PRINTED CIRCUITS SOON WILL BE CHEAP ENOUGH TO TRACK GROCERIES.

The big hurdles are standards and cost. P&G, which sells $40 billion a year in consumer goods, has joined the Auto-ID Center, a consortium of big names aiming to standardize the technology for retailing. They call it EPC, for electronic product code. Cost is the more serious problem. Silicon tags are pricey; today's cheapest run about a dime – too much for a can of garbanzos. "In grocery stores, the margins are infinitesimal," says Ananth Dodabalapur, who spent more than a decade at Bell Labs pioneering ways to screen-print transistors onto cheap, flexible materials. "The cost has to be in the pennies, not the tens of cents." The Auto-ID crew can't wait. It's testing silicon tags on pallets in Wal-Mart and Sam's Club stores in Oklahoma. In August, P&G plans to start tagging higher-end items such as perfumes. "We think we'll be able to get chips down to a nickel," says Kellam.

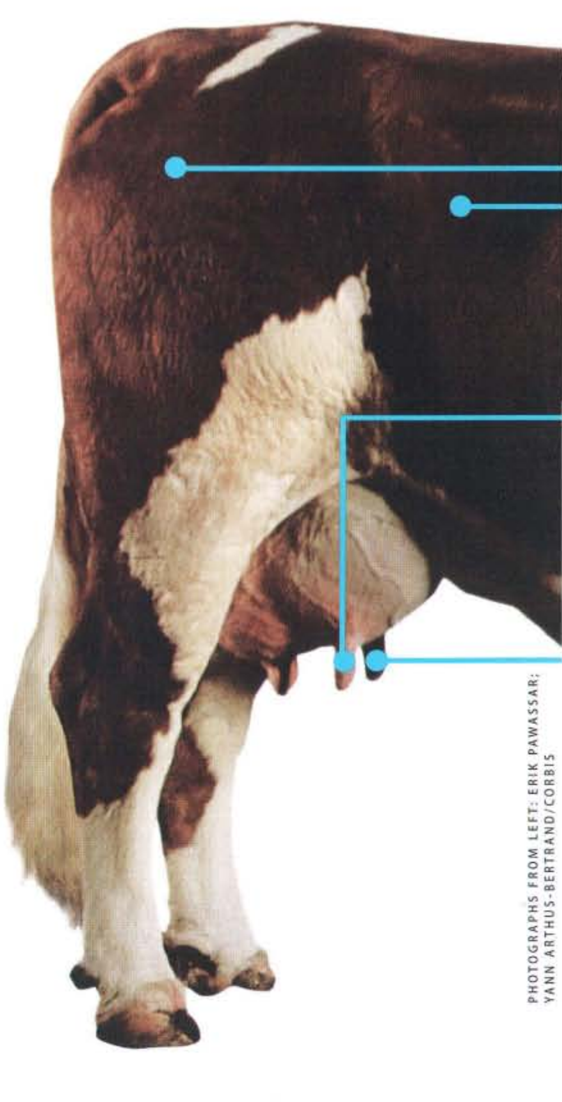
That's where Dodabalapur, Subramanian, and the other organics researchers come in. By replacing silicon with plastics, they figure they can cut the cost even more, to half a cent. Subramanian has built an inkjet printer that lays down capacitors and inductors on plastic, paper, or cloth. His "ink" consists of gold trapped in organic nanocrystal layers. As the device prints, it cooks the organics off. By redesigning the standard nanocrystals, he recently cut the temperature of this last step in half, making it compatible with inexpensive printing surfaces.

Banishing the barcode may require a combination of techniques, from microcontact printing, screen printing, and spin coating to inkjet printing and casting. It may also take time. Scientists estimate that commercially printed chips are still three to five years off. It'll be worth the wait. – *Michael Mechanic*

ATOMIZER

Smartcow

Today's cow may look the same as ever, but inside she's a picture of scientific innovation. Molecular biologists have honed the cow genome to create disease-resistant bovines, and the $36 billion-a-year cattle business in steak, leather, and milk has branched into pharmaceuticals, skin grafts, and replacement heart valves. Regardless of your animal politics, cow byproducts are everywhere – from the ink in high-gloss magazine graphics to the explosives an angry cattle-rights organization might place beneath that magazine's editorial offices, right down to the cinder blocks of the federal prison where those sad individuals would spend the rest of their sorry days. Isn't science amazing! Here, a roundup of the latest in cowtech. – *Charles Graeber*



PHOTOGRAPHS FROM LEFT: ERIK PAWASSAR; YANN ARTHUS-BERTRAND/CORBIS

THE GAS-X FACTOR

Cow flatulence produces some 80 million tons of methane worldwide a year – the greenhouse equivalent of 1.7 billion tons of CO_2. Entrepreneurs smell opportunity. By supplementing cattle feed with molasses and urea, the Virginia-based Global Livestock Group **reduces bovine emissions in the third world**. GLG measures the greenhouse savings (using patented ruminant flatulence-monitoring technology), then sells it as an offset to power companies needing to comply with tighter greenhouse emissions laws.

BORN TO BE TENDER

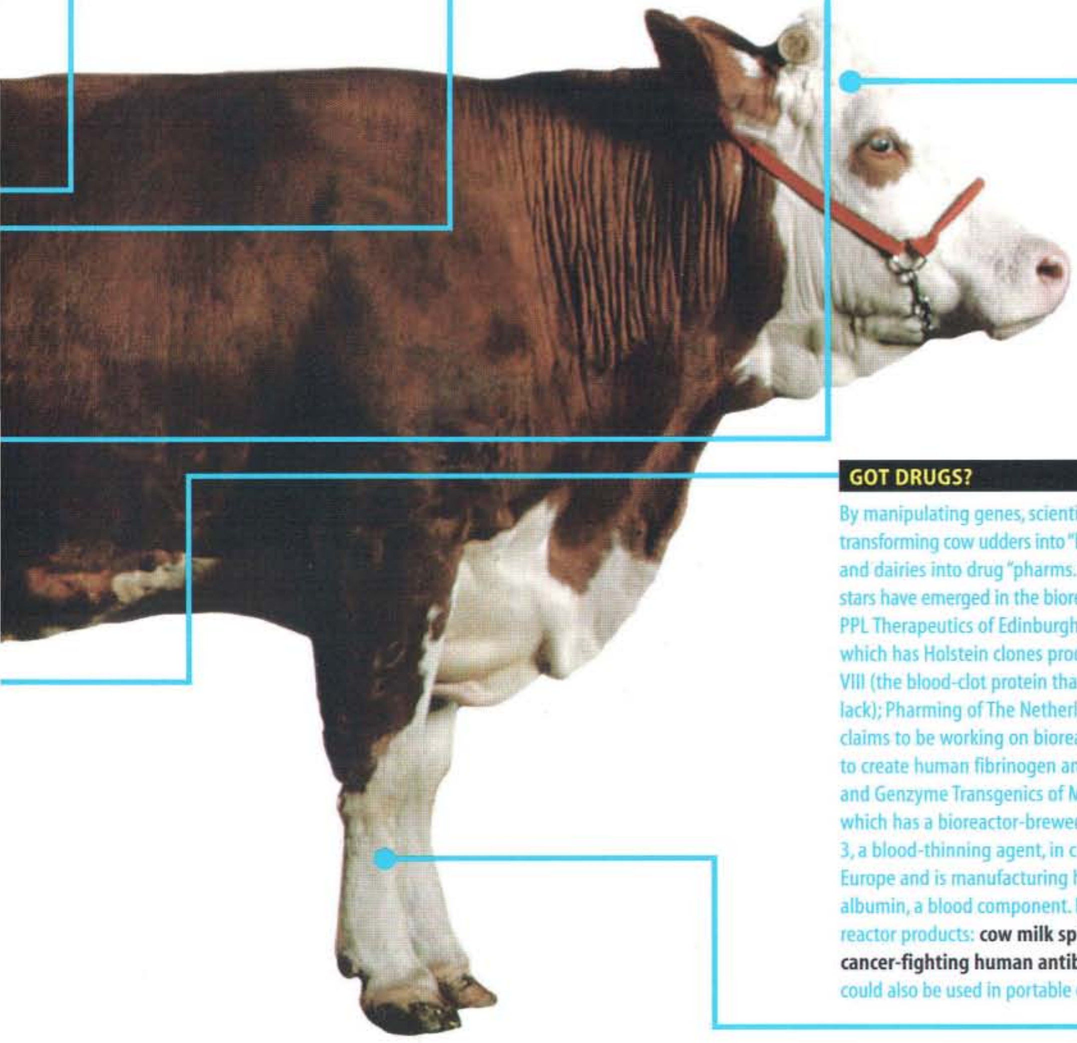
Three words: supertender filet mignon. That's just one of the genetic traits scientists are searching for among the 96.7 million cows in the US. (The Simmental below was selectively bred for beef and dairy uses.) Similar research is under way to produce cattle that are resistant to diseases like foot-and-mouth and mad cow. Cloning technology already allows researchers to **copy prize genetic specimens**, as Texas A&M scientists did in 2000 when they inserted the DNA of a bull with natural disease resistance into an empty donor egg – a process known as somatic cell nuclear transfer.

MILKING, FOR ALL IT'S WORTH

The average milk cow produces 7 to 10 gallons a day. One drag on productivity: mastitis, which costs the US dairy industry around $2 billion a year. This inflammation of the udder, caused by infection, afflicts 50 percent of all cows at some point. Scientists at the Gene Evaluation and Mapping Laboratory at the US Department of Agriculture have genetically engineered **heifers designed to produce a protein in their milk** to break down mastitis-causing bacteria. Pasteurization destroys the protein before the milk goes to market.

STOPPING THE MADNESS

Mad cow disease – bovine spongiform encephalopathy – perforates the animal's brain with billions of tiny holes, much like Creutzfeldt-Jakob disease in humans. Both diseases are believed to be caused by rogue pied-piper proteins called prions that "seduce" other proteins into changing shape. Several scientific teams are investigating BSE vaccines, and researchers at Texas A&M University aim to knock out the bovine prion-facilitating gene and create BSE-resistant cattle. The 180,000 cases of BSE worldwide were spread by cattle feed containing prion-infected tissue. The last FDA inspection found that **22 percent of processing facilities were violating new regulations** designed to keep reconstituted carcasses out of the cow chow. So far, no cases of BSE have been confirmed in the US.



GOT DRUGS?

By manipulating genes, scientists are transforming cow udders into "bioreactors" and dairies into drug "pharms." Three big stars have emerged in the bioreactor pasture: PPL Therapeutics of Edinburgh, Scotland, which has Holstein clones producing Factor VIII (the blood-clot protein that hemophiliacs lack); Pharming of The Netherlands, which claims to be working on bioreactor cattle to create human fibrinogen and collagen; and Genzyme Transgenics of Massachusetts, which has a bioreactor-brewed antithrombin 3, a blood-thinning agent, in clinical trials in Europe and is manufacturing human serum albumin, a blood component. Future bioreactor products: **cow milk spiked with cancer-fighting human antibodies** that could also be used in portable diagnostic kits.

STOCKROOM

Tendons from calves contain a collagen protein that, when cultured with human cells collected from the foreskins of newborns, forms a skinlike tissue. It's the first such product to gain FDA approval for treating diabetic and venous leg ulcers. The 3-inch round skin grafts, called Apligraf, are made by Organogenesis of Massachusetts and have been used on more than 35,000 patients. Medically useful bovine material is on a rampage. The valves from bull hearts are harvested in the slaughterhouse and sold as replacements for worn-out human ones. **Cow glands are plucked for processing into human hospital drugs** – everything from bovine heparin, which clears blood clots from catheters and hemodyalizers, to bovine thrombin, a blood enzyme essential for clotting.

Electronic Freedom Fighter

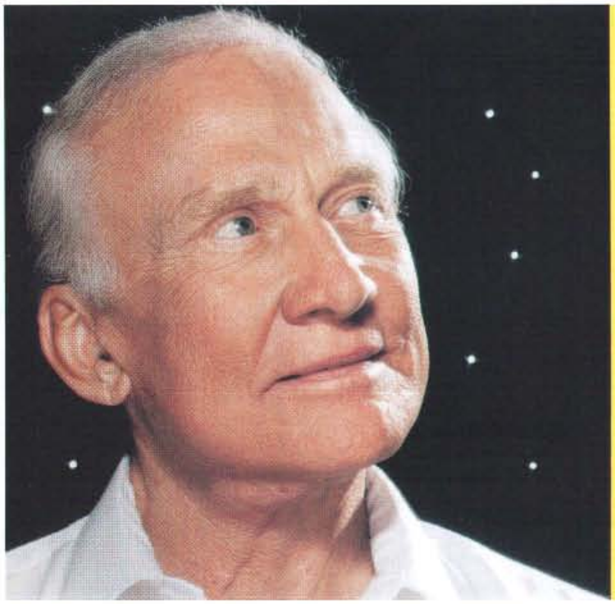
WHO: Barry Steinhardt, ACLU associate director and tech watchdog.

THE GOOD FIGHT: As head of the program on science and technology for the American Civil Liberties Union, he campaigns offline for freedom online.

PINT-SIZE PLAINTIFF: Steinhardt, 49, got hooked on in-your-face constitutional challenges at 13, when the ACLU backed his fight against being forced to read a Christian poem at eighth-grade graduation.

INTERACTIVIST: When he's not making father-daughter pilgrimages to Yankee Stadium (even he roots for the powerful occasionally), Steinhardt is helping the ACLU launch *www.treatywatch.org*. The site is one platform for speaking out against the Council of Europe's Convention on Cybercrime, which requires a crackdown on hacking tools. The treaty is up for US Senate ratification.

PRIVACY PROTECTOR: The former director of the Electronic Frontier Foundation monitors developments in face recognition technology and will chair the 2003 Computers Freedom and Privacy Conference. "Privacy is not dead," he says. "But it is on life support, and heroic measures are required." – *Ari Kaplan*



Starship Booster

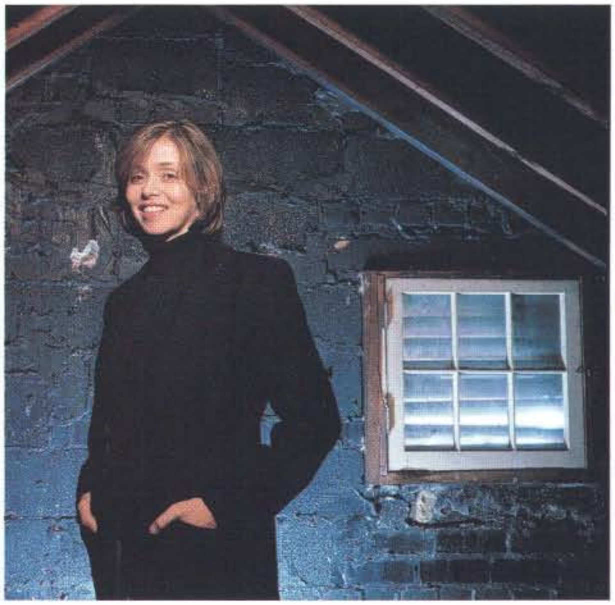
WHO: Buzz Aldrin, second man to walk on the moon and this planet's foremost promoter of space tourism.

MARS OR BUST: Teaming up with researchers at Purdue, the University of Texas at Austin, and MIT (his alma mater), Aldrin, 72, is developing gravity-powered "cyclers" that would slingshot between Earth and Mars. This spring, he asked NASA for $75,000 to expand the project.

RE-CYCLER: He's also pushing Earth-orbiting "space hotels" that house 75 to 100 passengers each. They'd be built from repurposed space shuttle fuel tanks.

SCRATCH AND FLY: Space travel should be open to all, "not just the wealthy guy who wants to take a vacation, but Joe Blow down the street," Aldrin says. One idea for getting Joe into orbit: a lottery.

CARTOON NETWORKING: Aldrin has promoted astrotourism on *The Simpsons* and *Space Ghost Coast to Coast*. But, he says, "sending Homer Simpson into space was the writers' intent, not mine." – *Chris Baker*



Zoomologist

WHO: Carol Traynor, serial scientist and cofounder of Cincro.

NEXT STOP, WONDERLAND: The chemistry PhD went from conducting the first chaos-fueled experiments at Thinking Machines to building virtual whiteboards for military applications. Her latest project is Cincro's Looking Glass, a Java tool that lets people work and play together on the Web.

MINDSHARE: Looking Glass blows instant messaging away. When others visit your zoomable canvas, or "zanvas," their icons pop up on the screen. Once there, everyone can pan and zoom around the windowscape, exchanging text, making sketches, and swapping images – all in real time.

FAMILY AFFAIR: Traynor, 37, started Cincro in the Washington, DC, burbs in 1996 with her husband, John Ko. She's the COO; he's the CEO. Weird entrepreneurial moment: A venture capitalist once thanked them for "disclosing" their marriage.

PRE-REVOLUTIONARY: She loves the colonial era. She and Ko were wed in Williamsburg, Virginia, and they've even decorated their home with period pieces. Traynor says this mental time travel "helps me step away from the most technical parts of my life." – *Neil McManus*

PHOTOGRAPHS FROM TOP: ANDREANNA SEYMORE;

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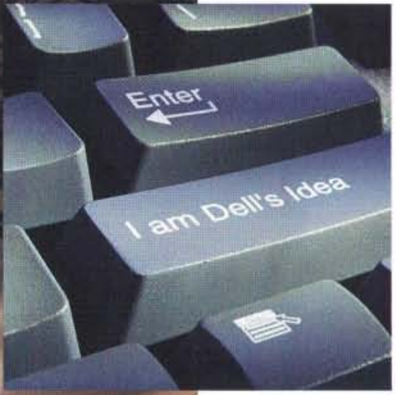
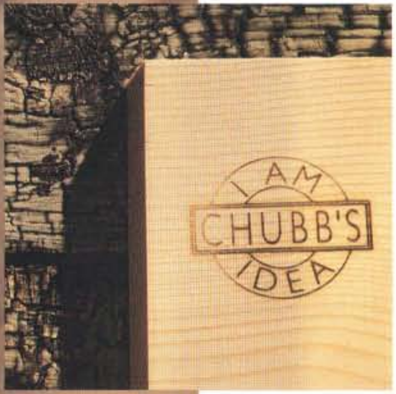
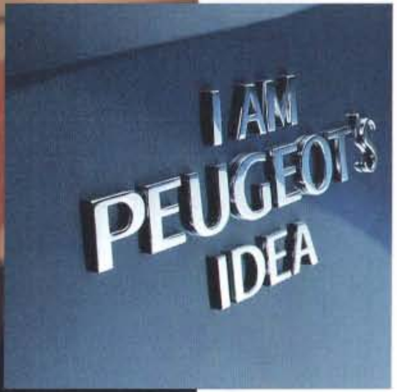


In early 2000, the world's number one computer company set out to upgrade its already world-class manufacturing infrastructure with a bold yet simple premise: "build more systems with less inventory." **I am Dell's idea, delivered.** In about 100 days, Accenture and Dell conceived and implemented an approach that allows Dell to operate on no more than two hours of inventory at a time. Now in place in Dell's plants around the world, this system has already generated a 500% return on investment, while enabling Dell to adapt more quickly to rapidly changing technologies.



Claims is the nexus of cost and service for property and casualty/general (P&C) insurers. Improvements to the claims process represent the single greatest opportunity for P&C carriers to reach the next level of profitability. **I am Chubb's idea, delivered.** Accenture is partnering with the Chubb Group of Insurance Companies to develop an easy-to-use Web-based solution to manage Chubb's claims process via the Internet. Drawing upon the most advanced technology available, this system is revolutionizing the claims process by allowing claims professionals to further improve the superior service for which Chubb is known.



As one of Europe's leading automakers, Peugeot saw the potential of eCommerce as a means to enhance and strengthen relationships among manufacturer, dealers and customers while also providing an opportunity to extend its market reach. **I am Peugeot's idea, delivered.** Drawing upon a combination of vast auto industry experience and Internet savvy, Accenture helped create peugeot.fr, a b-to-c website that includes a state-of-the-art showroom, used car searches and dealer contact integration.

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JARGON WATCH

Premium Practice
A controversial health care trend in which patients are given preferential treatment if they pay their doctor a yearly membership fee (which can run up to $20,000 per family). Aka "boutique care."

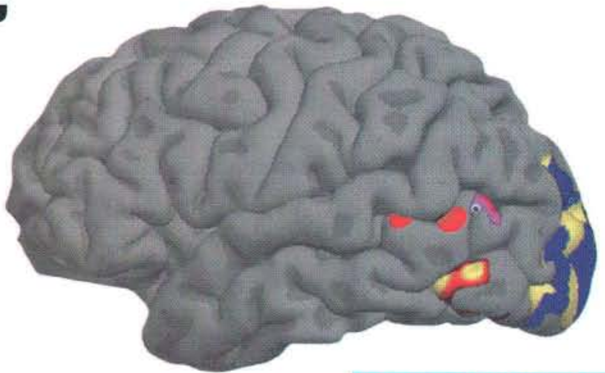
Self-Healing Grid
A proposed electrical power infrastructure that would monitor itself through an array of sensors, run simulations to identity potential glitches, and then correct itself to avert problems.

Sudden Reputation Death Syndrome
The complete and instantaneous loss of all credibility, support, and near-term job prospects after being caught up in a high-profile scandal (e.g., Enron's Kenneth Lay and Clinton adviser Dick Morris).

Visual Area Networking
What SGI calls its new collaborative graphics technology, which allows remote PC users to access and manipulate complex 3-D images stored on a centralized supercomputer.
– *Gareth Branwyn*
(jargon@wiredmag.com)

Liar, Liar, Brain's on Fire

LIE DETECTION The caveman who told the first fib must have figured it was a great idea – until the backlash began. Early lie detectors (say, threatening to beat the crap out of a suspected liar) evolved into more sophisticated techniques like the rack and kneecapping. Though the polygraph civilized things, it proved scarcely more reliable: Practiced liars could fool it, and anxious truth-tellers set it off. These days we're more advanced, at least in our technology. – *Jennifer Kahn*



Busted: An fMRI maps changes in blood flow.

BRAIN FINGERPRINTING

How it works: The subject is shown a photo – perhaps of the yard where a murder victim was buried – while an electroencephalogram records his or her brain waves. Telltale squiggles reveal whether the person recognizes the scene.

Applications: Criminal trials and other legal proceedings. Eccentric neuroscientist Larry Farwell's machine has already been used in an Iowa court by a convicted murderer petitioning for a new trial. The test showed that the defendant, Terry Harrington, had no memory of the crime scene, but the judge refused to accept it as evidence. Lawyers will keep pushing.

Appeal: It's a hard machine to fool.

Just one problem: It doesn't work for lies that don't involve memory, like "Of course I love you" or "This is the finest used car on the market."

THERMAL IMAGING

How it works: A heat-sensitive camera registers increased blood flow around the eyes.

Applications: Cameras could someday read the faces of air travelers when asked whether they're carrying a bomb.

Appeal: Images can be captured at a distance.

Just one problem: Only 80 percent effective. It will go off at almost any emotional rush, like realizing that you left your wallet at home.

FUNCTIONAL MRI

How it works: Detects information suppression by recording changes in blood flow to different parts of the brain.

Applications: All theoretical for now. Eventually, it could apply to anything from perfectly mediated, full-disclosure lawsuits to creepy government interrogation chambers.

Appeal: It can see your brain remember things.

Just one problem: The enormous and expensive machine only works if the subject is consciously suppressing information; a self-deluding perpetrator won't scan.

AUTOMATED FACE ANALYSIS

How it works: A computer system registers and analyzes the micro-expressions that flit across the human face.

Applications: In theory, any situation where constant monitoring is an advantage: screening witness testimony, for example, or verifying responses during a job interview.

Appeal: It doesn't need a behavioral baseline, and it can be done at a distance. Good at catching even practiced liars who could fool a polygraph. Can also be used to identify suicidal patients.

Just one problem: Computers are still worse than people at recognizing facial expressions.

BIG NUMBER

160

IDEAL POPULATION OF A SPACE VILLAGE

University of Florida anthropologist John Moore used simulation software to arrive at the magic number of people necessary to sustain a stable population on a multigenerational space voyage. Each adult would have 10 potential mates.

IMAGE: COURTESY MARTINOS CENTER, HARVARD MEDICAL SCHOOL

CAR TECH:
Driving Innovation

DRIVING WHAT'S NEXT: AN INDUSTRY IN MOTION

The architects of the automotive future are always in motion, reshaping the experience from the outside in. From sleek styling and breakthrough design to state-of-the-art communication systems and ultrasonic safety sensors, the focus is on innovation — getting today's mobile mavericks right where they want to be.

DESIGN DIRECTION: BACK TO THE FUTURE

Luxury's no longer limited to the higher end of the price spectrum. There's an upbeat trend in automotive design today: classic style with an eye on the future — at a very affordable price. Who could miss Chrysler's big vault into the 21st century with the introduction of the PT Cruiser, a spirited classic that's turned heads from coast to coast? With a nod to nostalgia, the PT Cruiser is still firmly focused on what lies ahead. Next in line? The PT Convertible hits the streets in 2004, cranking up the style quotient with sleek new dimensions.

"Many say the Chrysler PT Cruiser is two vehicles in one," says Trevor Creed, senior vice president of design for the Chrysler Group. "It has a certain modern look when the top is down, with its sport bar and long passenger compartment. Yet when up, the top has a slammed-forward retro-position, much like a '30s custom-chopped coupé, emulating the tension of an archer's bow being drawn back. Lower, sleeker, with even more attitude, the PT Cruiser Convertible styling study is the latest example of the sort of fun we can have with PT Cruiser. And there's more to come."

The stoplight stare.

It's when a quick glance at a new set of wheels becomes a jaw-dropping gape. Well, let the staring begin. After all, the 2002 Chrysler PT Cruiser deserves more than a short look.

With daring design characteristics like a distinctively pronounced grille, rounded fenders, chrome push-button door handles, and bullet-shaped taillights, people just can't help standing frozen in a state of wonder.

The surprises continue inside, where an extremely versatile interior includes up to 32 seating configurations,* which unfold amid 120 cubic feet of interior room. The flexibility continues with additional reasons to gaze, like the adjustable tray table and multiple power outlets.

Now get ready for a look ahead, because the new PT Turbo arrives this fall. Want a sneak peek? Here it is: the PT Turbo has a 2.4 liter DOHC 16-valve inter-cooled High Output turbo engine, which yields 205 horsepower, a heavy-duty 5-speed transmission, and 17" blade, silver 5-spoke cast aluminum wheels. So prepare — because the staring will now be combined with a sharp swivel of the head. Call 1.800.CHRYSLER or visit chrysler.com.

*With available fold-flat front passenger seat

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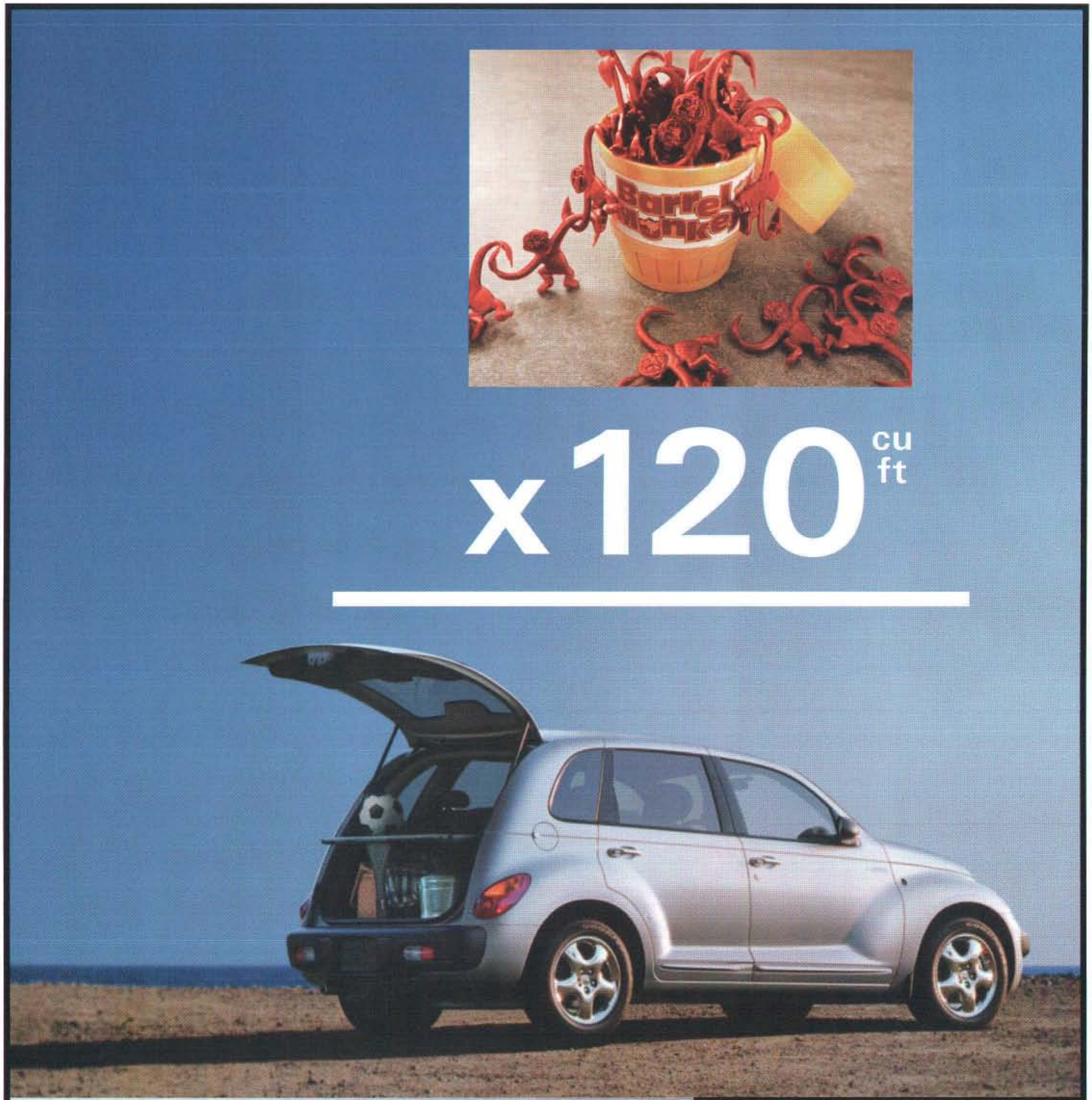

PT CRUISER

Take 120 cubic feet of room, add 32 seating configurations,* and what do you get? More fun and possibilities than you can shake a barrel of monkeys at. Call 1.800.CHRYSLER or visit chrysler.com.

CHRYSLER

Drive=Love

*With available fold-flat front passenger seat. BARREL OF MONKEYS® & ©2002 Hasbro, Inc. Used with permission.

> **"...the telematics market is expected to top $3.5 billion by 2006..."**

COMMAND PERFORMANCE: TELEMATICS TAKES HOLD

Imagine hopping into a car that's wired to place calls, answer email, check voice mail and call up headlines and weather conditions — all at the sound of your voice — so you can keep moving forward with your eyes on the road.

Today's most progressive companies are taking the latest emerging technologies and synchronizing them with existing features in automobiles. Currently available from leading telematics integrator Johnson Controls is a hands-free system that seamlessly adapts to drivers' own electronic devices.

"Our in-vehicle telematics solution directly addresses the consumer's desire to use the cellular phone and wireless service provider of their choice," says Mark Zeinstra, director of telematics at Johnson Controls. "That's because Johnson Controls' open architecture is designed with Bluetooth as the integral enabling technology. What's really unique about it is that we've designed our solution to evolve easily from today's cell phone, to the multi-purpose mobile devices that are just coming to market."

With the telematics market expected to top $3.5 billion by 2006, and virtually every automaker geared up to have the technology by 2025 (Telematics Research Group), the future of auto intelligence is looking sharper than ever.

BlueConnect™ means you connect....

...to information and people while you're in your vehicle. With Johnson Controls' BlueConnect™ hands-free system and a Bluetooth-enabled cell phone, you can connect to the office, home and friends whenever you like to check email, voice messages, or just stay in touch. Just talk, and your voice activates the system to make and answer calls, while you keep your hands on the wheel and eyes on the road.

Johnson Controls' BlueConnect™ is designed to keep pace with tomorrow's digital personal device technologies and is superior to any analog technology on the market today. When you're ready for a new cellular phone, choose one that's Bluetooth-enabled – and it's immediately ready to use in your vehicle.

BlueConnect is the centerpiece of Johnson Controls' innovative total vehicle interior product suite. AutoVision® is a rear-seat entertainment system that blends Johnson Controls' expertise in overhead systems, acoustics and interior integration. The HomeLink® Wireless Control System provides an integrated connection between your car and home for greater security and convenience. All of these Johnson Controls products are designed with extensive comfort testing, human factors engineering and world-class technologies.

When you're ready to connect, look for BlueConnect™, the most innovative in-vehicle hands-free system available.

www.jci.com/asg-electronics

JOHNSON CONTROLS

The freedom to choose.
The freedom of the new telematics.

No cellular extras necessary.

Freedom isn't a goal you seek; it's a road you choose. So Johnson Controls chose a different road to telematics – one that would give drivers flexibility.

Instead of creating embedded in-vehicle systems, we collaborated with leading companies such as IBM and Intel to provide open solutions. This gives automakers the freedom to offer systems and services drivers already recognize and use. Our telematics approach allows drivers to simply use their own devices in the vehicle – without cumbersome extras.

Choose the road to freedom. Choose Johnson Controls telematics.

www.johnsoncontrols.com

TECHNOLOGY THAT *touches* PEOPLE

JOHNSON CONTROLS

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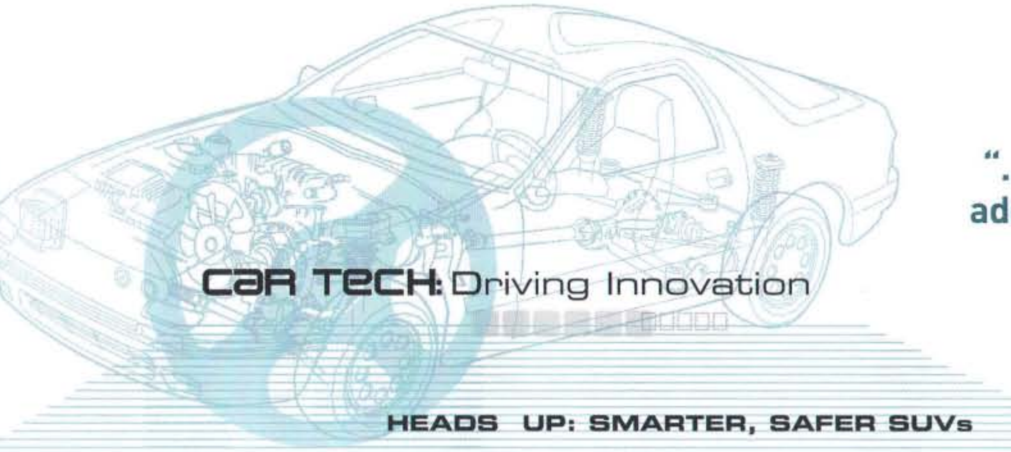

"...ultrasonic sensors provide an additional set of eyes and ears..."

HEADS UP: SMARTER, SAFER SUVs

Putting a premium on safety has led to plenty of very cool SUV features — from electronic braking and traction systems to in-vehicle projected displays. The recently released 2002 Buick Rendezvous features an innovative head-up display that projects the information normally available on a car's dashboard onto the lower left corner of the windshield, so that drivers have easy access to pertinent data while keeping their eyes on the road.

The Rendezvous takes the premium sedan to a whole new level, combining SUV performance with trademark Buick comfort and style. It's also loaded with plenty of high tech gear, including ultrasonic sensors which provide an additional set of eyes and ears — indicating vehicle proximity for precision while parking or monitoring internal movement once the car's been locked — communicating with the driver when needed most.

"An important part of Buick's heritage has been to provide our customers with a real sense of safety and security when traveling in their vehicles," said Rendezvous brand manager Chris Mazglad. "Rendezvous carries that tradition forward with advanced features such as Versatrak and OnStar. But we've gone a step further and made available luxury items that our customers value like head-up display and ultrasonic rear park assist."

Tomorrow's SUVs are making the most of cutting edge technologies, offering enhanced security and performance without veering away from luxury, style, and a very smooth ride. ■

Buick Rendezvous: It's a stroke of "ingenious."

Technically speaking, the introduction of the Buick Rendezvous didn't just bring you a new vehicle. Instead, it helped invent a new category. This is an extraordinary machine that offers the ride and feel of a luxury sedan, the room and versatility of a minivan and the style and capabilities of an SUV. All in one beautiful, highly innovative package.

Rendezvous' ingenious, reconfigurable interior features multiple power ports and a unique center console personal equipment organizer designed specifically to stow things like laptops and cell phones out of sight. With its available third-row rear seats in the "up" position, it can comfortably carry seven full-grown adults. Fold the seats flat and it can easily handle four-foot wide building materials. When it comes to driving, you'll appreciate Rendezvous' available Versatrak™ on-demand all-wheel drive system that instantly adapts to changing conditions, providing traction where you need it. And its smooth-riding independent suspension and 185-hp V6 deliver the kind of ride and over-the-road feel that most SUVs can only dream of.

The 2002 Buick Rendezvous. It takes technology to a whole new place. Take a closer look at www.buickrendezvous.com. And while you're there, check out the latest information available on current offers and promotions.

BUICK RENDEZVOUS
it's all good™

www.buickrendezvous.com

Weigh your options. The new 2002 Buick Rendezvous offers the ride of a luxury sedan, the seating capacity of a minivan and capabilities of an SUV in one innovative package, with available features like Versatrak™ on-demand AWD and reconfigurable seating for up to seven adults. The scales don't lie. Find out more at **www.buickrendezvous.com.**

Starting at $25,795. Rendezvous CXL shown, $33,010. (MSRP. Tax, title, license and optional equipment extra.)

BUICK RENDEZVOUS
it's all good™

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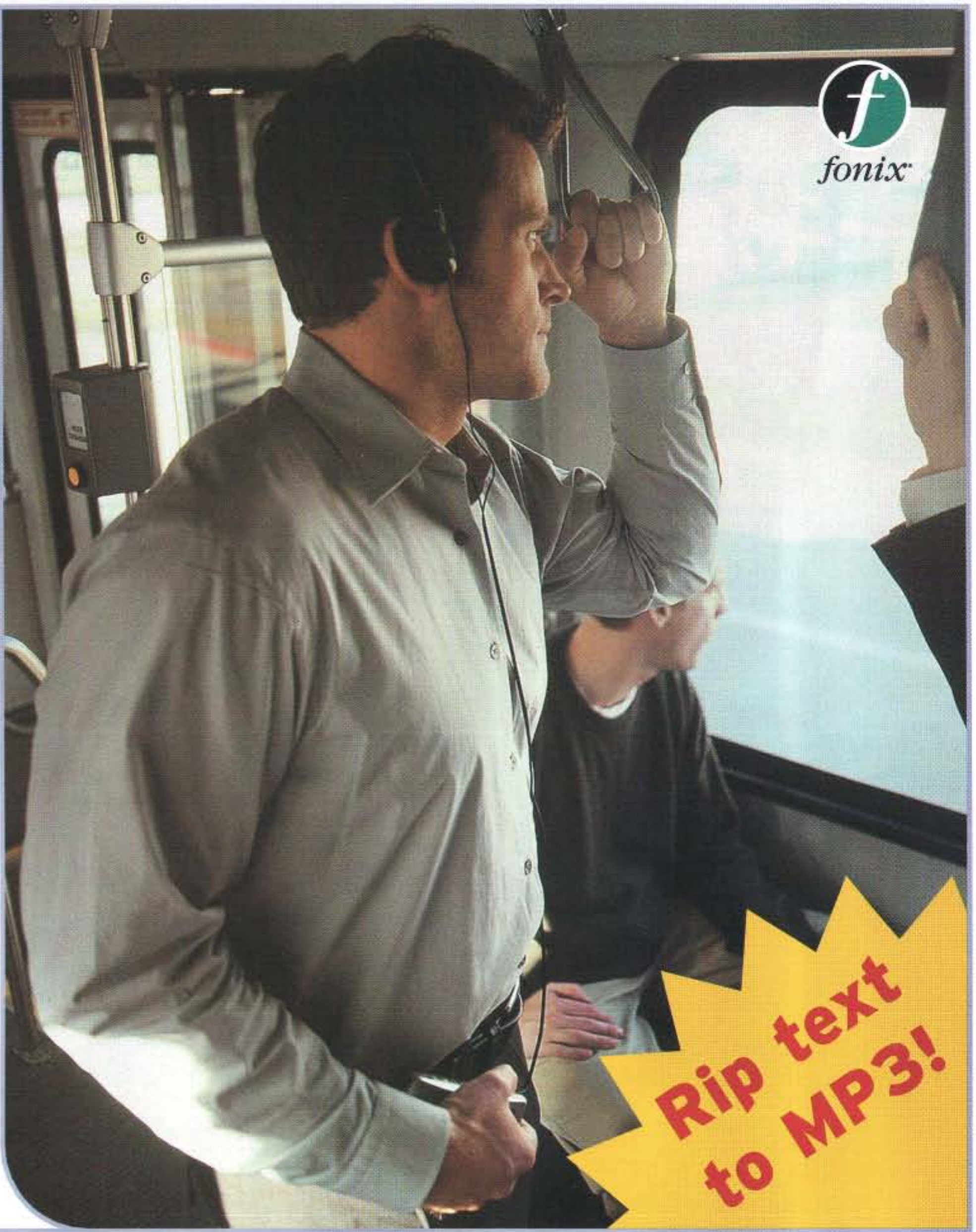
See the Big picture.



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Winner's Curse

By Chris Anderson

Of all the sins and excesses of the tech bubble, perhaps the most damaging took place not in Silicon Valley, New York, or Houston, but in a government office in central London. There, on April 27, 2000, the UK auctioned off five licenses for 3G wireless spectrum, raising a whopping $35 billion. Bureaucrats fell over themselves with joy, economists toasted the success of auction theory, and British taxpayers celebrated the historic transfer of wealth to the public purse. Over the next year, a half-dozen other European countries held their own auctions, raising a combined $100 billion in a frenzy of overbidding.

Where did all that money come from? Loans, which have become crushing, industry-killing debt. Now, in what appears to be the ruins of the 3G dream, European wireless business is suffering. Some carriers may go bankrupt, potentially causing Enron-like shock waves. Even if 3G works – so far it hasn't – auction winners can't afford to buy the equipment necessary to roll it out.

The marketplace didn't ask for 3G. European regulators created it to extend the success of GSM to high-speed data. But cheaper routes to always-on dataphones, like Japan's i-mode, have emerged, and as a result 3G may become one of history's greatest failures of industrial policy. Technocrats have blown it before, but the difference between mistake and disaster this time is the crippling, out-of-control auctioning of spectrum.

The 3G auctions were the last party of an old regime.

Economists love auctions. They see them as a market-based (read: fair) alternative to "beauty contests," in which regulators hand out licenses to the most attractive candidates. Auctions are thought to reveal a spectrum's true value since bidders set the price, paid in the form of a charge against future users (who ultimately will bear the cost in higher rates). Because they pay up front, the winners have an incentive to bring services to market quickly as a way to recoup costs. Or so the theory goes.

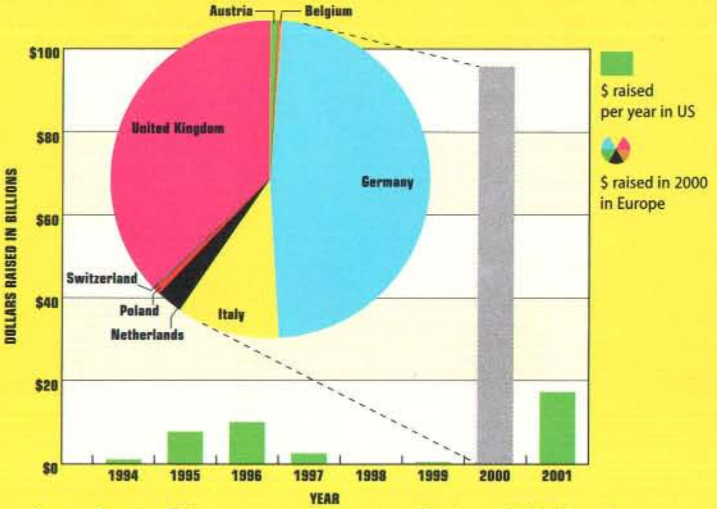
In the past, auctions were justified by the premise that airwaves can be so easily mucked up by interference that they must be fenced off into regulated monopolies. Such is the case with the analog world. Dumb radio signals need protection because they can't protect themselves; they overlap and are drowned out, like voices in a crowd. But digital signals are defined by the information they contain, not frequency or amplitude. Many transmissions can share the same space, just as unrelated packets share the Internet's fiber arteries. Smart digital radios are adaptive, constantly negotiating between transmitter and receiver to find pockets of clearer air, extending their range.

Think of the difference between an old analog cordless phone and today's digital versions. To keep the old phone from interfering with a neighbor's, you'd select a free channel. Modern phones use digital spread spectrum technology, which allows many calls to share the same frequency. Technology obviates the need for policy.

Most digital cell phones, including those with the proposed 3G standards, work the same way. So why are they being regulated? The usual answer: Even in the digital world, there are limits. Coding may allow signals to share the airwaves, but the bits continue to ride on radio waves. Spectrum remains vulnerable to overexploitation; it can't be shared by everyone all the time. Lacking an easy way to control dynamic sharing, regulators take the road they know best: granting monopolies.

Into Thin Air

Europe didn't invent digital spectrum auctions; the US began raffling off PCS in 1994. But 3G took the concept to a new level, raising nearly $100 billion – which, with the technology now stalled, is looming large over the industry.



Sources: Forrester, FCC

Chart compiled by Stuart Luman

But two technology trends may finally topple this makeshift structure and signal the end of the auction. The first is 802.11b (a k a Wi-Fi), which uses spread spectrum in a special unregulated band to send broadband data over a short range. Over the past few years, Moore's law has driven down the cost of Wi-Fi network equipment, allowing the technology to expand from offices and homes into public spaces. Each added node raises the possibility of an ad hoc microcellular network that can achieve much of what 3G has promised – but below the regulatory radar.

The other blow to scarcity-driven policy is ultrawideband, which extends the spread spectrum concept over a wider range of frequencies, enabling more devices to share the airwaves. In February, the FCC approved the first ultrawideband devices. Only very low-power gadgets with short ranges are being allowed on these frequencies initially, to avoid spectrum swarming. But if all goes as expected, the same technology could be given free range.

Both technologies take lessons from Internet economics – favoring pragmatism over paternalism – and neither needs the protection of billion-dollar, government-imposed monopolies. Imagine tiers of service with users paying to avoid congestion rather than being sheltered from it by the FCC.

Technology can even have the effect of expanding available spectrum. As the cost of transmitters drops, networks can be subdivided into smaller and smaller cells. Smart antennas will allocate signals directionally on the fly.

When the telecom world recovers from its hangover, the mania of 3G auctions will be seen as the last party of an old regime. Where airwaves still need protecting (voice, for now), beauty contests may return, rehabilitated, based on successful models in Sweden and Japan. Where they do not, technology will help markets self-regulate. And politicians will just have to go back to the dirty work of balancing budgets and justifying taxes, shedding the occasional tear for the golden calf that got away. ■ ■ ■

Chris Anderson (canderson@wiredmag.com) is Wired*'s editor in chief.*

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People v. High Tech

Investors Set New Record for Class-Action Lawsuits

Shareholders lost $4.5 trillion since the start of the dotcom bust – and now they're looking for someone to blame.

A record number of class-action shareholder lawsuits hit publicly traded US companies in 2001 – more than twice the number of claims logged in 2000. For good reason: The suits pay off. Average settlement payments have nearly doubled since the mid-'90s, $11.9 million today versus $6.1 million in 1994.

Suing the CEO wasn't supposed to be such a sure bet. The Private Securities Litigation Reform Act of 1995 was intended to slow litigants' rush to the courthouse by forcing them to show more up-front proof of fraud, among other things. But the tech-stock boondoggle of the late '90s spurred a whole new angle for class action – so-called IPO laddering schemes. In these deals, corporations colluded with underwriters who extorted heavy commissions in exchange for arranging stock purchases at preset prices after the offering. As a result, so the shareholders' accusations go, share values were inflated artificially. (The gambit may have been wielded by Credit Suisse First Boston, which recently settled with the SEC for $100 million.)

The good news for corporate America is that the Fed is now demanding more IPO-related disclosures. The bad news for shareholders and firms alike: Allegations of earnings restatements and accounting fraud – red flags for potential shareholder lawsuits – are on the rise in the wake of Enron and Global Crossing. Next on the hit list: biotech. Twenty-nine percent of all IPOs last year came from the health care and biotech sectors, up from just 4 percent in 1999. And so far, few firms are turning into the gold mines they once seemed. – *Mike Drummond*

The number of IPO laddering-only cases: 140
The number of companies embroiled in class-action suits in 2001 that also restated earnings: 70
Most active district court: Southern District, New York
Most frequently sued sector: tech
Most frequently sued industry: software/programming
Most common form of accounting allegation: improper revenue recognition
Percent of cases that allege insider trading: 56
Percent of cases that allege accounting fraud: 60
About 98 percent of cases not thrown out are settled.

MOST TARGETED COMPANIES (by number of claims)

ENRON (32 claims) accounting fraud (restated earnings)
CRITICAL PATH (22) IPO laddering
AMAZON.COM (16) misleading financial forecasts/insider trading
PROVIDIAN FINANCIAL (16) misleading financial forecasts/insider trading
ONYX SOFTWARE (16) accounting fraud (restated earnings)
CLARENT (15) IPO laddering
DR. KOOP LIFECARE (15) IPO laddering
METROMEDIA FIBER NETWORK (15) misleading business statements
NUANCE COMMUNICATIONS (15) misleading financial forecasts/insider trading
STARMEDIA NETWORK (15) IPO laddering/accounting fraud (restated earnings)
ACLN (14) misleading financial forecasts
GENESIS INTERMEDIA (14) paying financial pundit Courtney Smith to pump the company on CNN, CNBC, Bloomberg Television/insider trading
XO COMMUNICATIONS (14) accounting fraud
ADAPTIVE BROADBAND (13) accounting fraud (restated earnings)
ORACLE (13) accounting fraud (restated earnings)/insider trading
BROADCOM (12) accounting fraud/insider trading
FREEMARKETS (12) IPO laddering
NEW ERA OF NETWORKS (12) accounting fraud (restated earnings)
NORTEL NETWORKS (12) misleading financial forecasts
TUT SYSTEMS (12) misleading financial forecasts/insider trading

Shareholder Lawsuits, 1991-2001

ANNUAL NUMBER OF CLAIMS
AND MOST TARGETED INDUSTRIES

2001: 484 claims
1) Software/programming/computer services
2) Telecommunications equipment
3) Telecommunications services

2000: 216 claims
1) Applications software
2) Networking products
3) Telephone systems

1999: 209 claims
1) Applications software
2) Computer software
3) Commercial services

1998: 236 claims
1) Computer software
2) Telecommunications equipment
3) Health care

1997: 178 claims
1) Commercial services
2) Computer software
3) Networking products

1996: 110 claims
1) Electronic components/semiconductors
2) Wireless equipment
3) Applications software

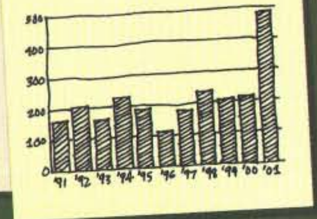
1995: 188 claims
1) Electronic components/semiconductors
2) Telecommunications equipment
3) Computer software

1994: 231 claims
1) Computer software
2) Telecommunications services
3) Medical/biotechnology

1993: 163 claims
1) Computer software
2) Electronic components/semiconductors
3) Computer memory devices

1992: 202 claims
1) Medical/drugs
2) Computer hardware
3) Computer software

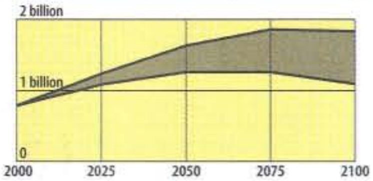
1991: 164 claims
1) Commercial banks
2) Computers
3) Superregional banks



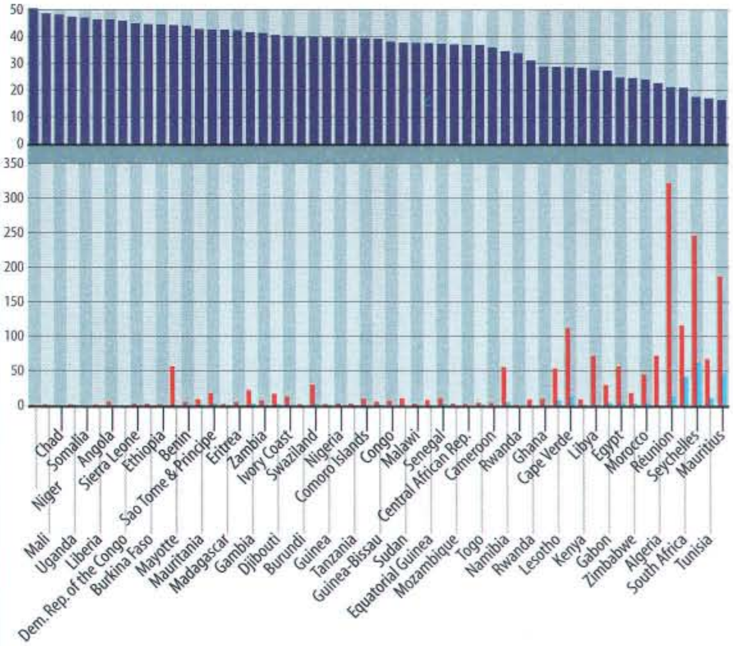
Sources: Bloomberg; National Economic Research Associates; Stanford Law School Securities Class Action Clearinghouse

AFRICA

Sub-Saharan Africa has the youngest population in the world today. But by 2100, it will have a greater percentage of people over 60 than Europe does now.



BIRTHRATES AND TECHNOLOGY, 2001



POPULATION STAGES

STAGE 1 High birthrate, high death rate, little population growth

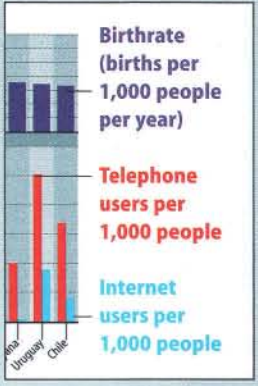
STAGE 2 High birthrate, declining death rate, rapid population growth

STAGE 3 Declining birthrate, low death rate, slowing population growth

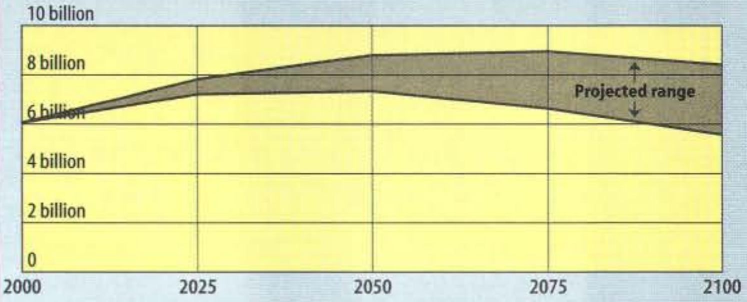
STAGE 4 Low birthrate, low death rate, little population growth

STAGE 5 Very low birthrate, low death rate, declining population

KEY



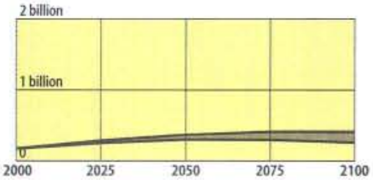
WORLD POPULATION



Sources: CIA World Factbook 2001 (*www.cia.gov/cia/publications/factbook*); US Census Bureau; "The End of World Population Growth" (*Nature*, August 2001); *Population Geography*, by Gary Peters and Robert Larkin (Kendall-Hunt)

MIDDLE EAST

Saudi Arabia is tech-savvy for its region (there's one phone per seven people), yet female literacy is barely above 50 percent. This may stall any drop in population.



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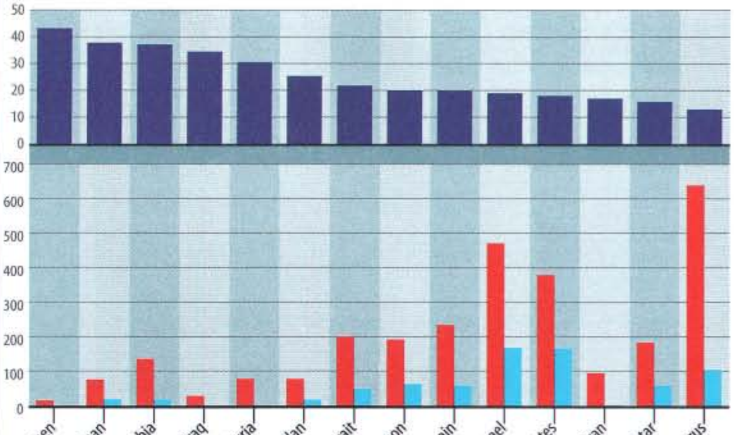
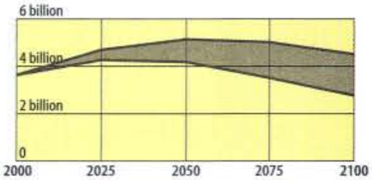
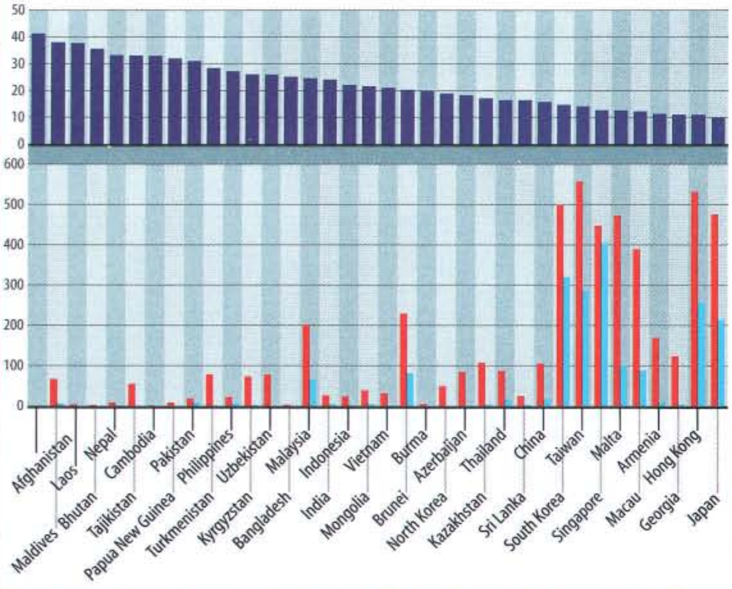


ASIA

The Eastern Pacific will have the oldest population in the world by the end of this century, when about two-thirds of Japanese will be at least sixtysomething.



BIRTHRATES AND TECHNOLOGY, 2001



The Population Bust

As Technology Spreads, Birthrates Will Drop

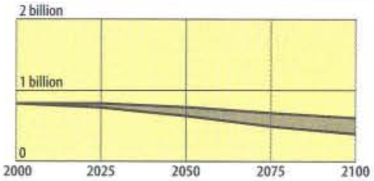
The fifth stage. It's an alarming concept in most demographic circles – the idea that populations in developing nations will shrink this century, as technological advances like telephones and the Internet lead to the widespread use of birth control. But so argues Warren Sanderson, who recently helped write a breakthrough paper on Earth's decreasing head count. He points to 11 countries where the fertility rate has already fallen below the replacement rate, leading to population declines. Trends like these, he says, indicate that the number of humans in the world will peak just below 9 billion in the next 100 years. And there's even a small yet real chance that fewer people will inhabit the planet in 2100 than in 2000.

This bucks more conventional notions of world overpopulation, which for decades has been a tale of two extremes. In the developed world, numbers held steady – or dipped – as technological advances drove literacy rates up and birthrates down. In undeveloped areas, however, limited access to health care and education kept population growth on the upsurge. Even when technology spread, demographers noticed a spike in the rates, as food production increased and infant mortality dropped. If Sanderson's theory plays out, there may not be much life left in overpopulation. – *Patrick Di Justo*

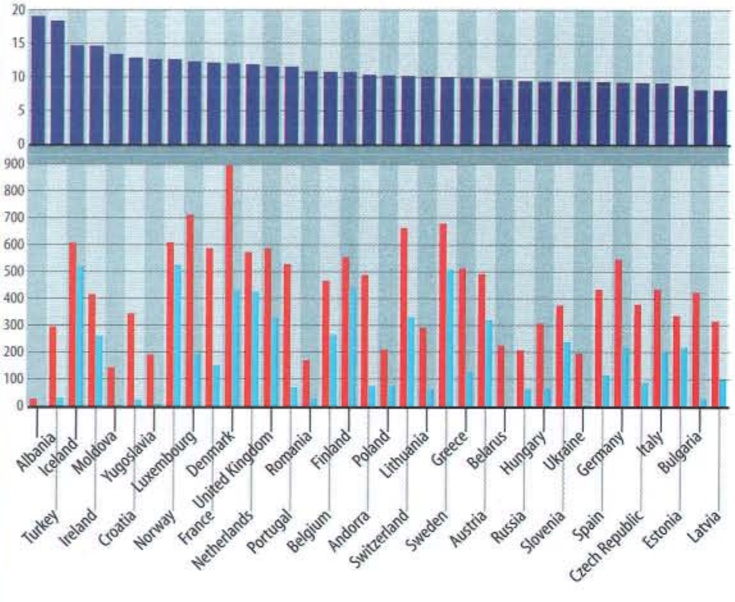
Note: Projections assume that the average person will live for 80 to 120 years and that low fertility trends will continue over the next century. If a sudden breakthrough that leads to greater longevity occurs, expect to see a short-lived baby boom followed by a collapse in the birthrate.

EUROPE

Russia's population peaked in 1992 at 148.6 million. By 2100, it could lose half of its people, and 50 percent of those who remain may be 60 or older.

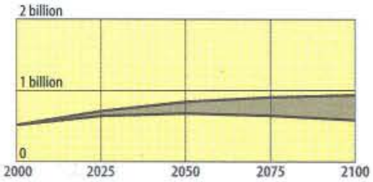


BIRTHRATES AND TECHNOLOGY, 2001



LATIN AMERICA

Mexico City, the most populous metropolis in the developing world, is home to 16 percent of Mexico's people. By 2050, the country's numbers will stabilize.



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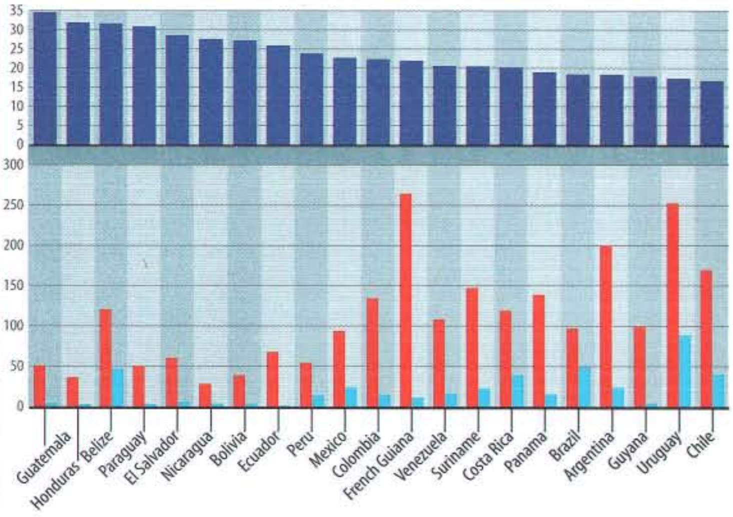
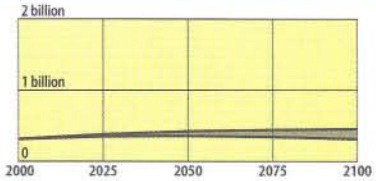


NORTH AMERICA

The United States is the only nation in the developed world whose birthrate is not expected to decline dramatically in the 21st century.



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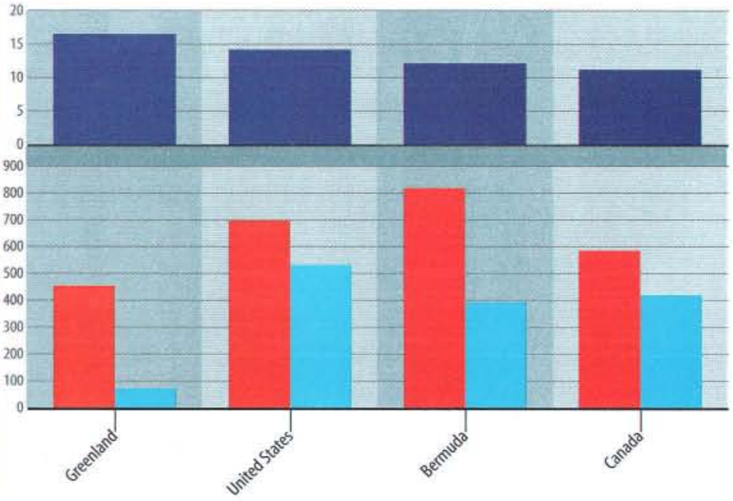

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The Remastered Race

Artificial chromosomes and in vitro screening are giving new life to the eugenics debate. The question is not whether we want to engineer embryos but how far it should go. By Brian Alexander

You'll hear the debate on *Crossfire* or *NewsHour* or perhaps *The 700 Club*. There'll be coverage in your newspaper, probably accompanied by thundering editorials - ripe with clichés like "slippery slope" and "brave new world." It will sound, in fact, a lot like last year's dustup over stem cells and cloning. But this summer's biotech grudge match will be over designer babies.

Two new books are framing the debate. In *Our Posthuman Future*, heavyweight social and political theorist Francis Fukuyama warns of "class war" and the eventual obliteration of what it means to be human - all as a direct consequence of genetic fiddling. It comes out April 10. The very next day, Gregory Stock's *Redesigning Humans* will hit stores. Stock, director of the UCLA School of Medicine's Program on Medicine, Technology, and Society, celebrates the promise of genetic engineering: longer lifespans, better health, smarter kids.

In the ensuing made-for-TV matchups, expect Fukuyama's followers to toss a hand grenade from history - eugenics. Look for Stock and his supporters to cry foul and bat the word away as a relic from the Third Reich.

Do not get caught up in the rhetoric. The fact is, eugenics is here. Brought to you by high technology and the free market, it looks nothing like a Nazi newsreel. The question isn't "Should we have eugenics?" but rather, "How far should we go?"

This is not an academic question. The technology to create

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wholesale alterations in the genome, and to take charge of human evolution, is already in development.

Take the notion of an artificial chromosome. Chromos, a Vancouver-based biotech firm, is growing artificial chromosomes inside cells the way the Japanese grow pearls in oysters. Chromos farms them, seeding cells with a DNA structure called a centromere. Then its scientists use a machine called a flow cytometer to separate natural chromosomes from artificial ones at a rate of up to 2 million an hour.

Just like natural chromosomes, these artificial ones are made of chromatin, ropes of DNA molecules and proteins. But there's a difference. Natural chromosomes are like a CD issued by a record company. They come prerecorded with genes that tell cells what to do. The artificial chromosomes flowing out of the cytometers at Chromos are blank, ready for anything from the Melvins to Mozart, meaning that Chromos can burn onto them whatever genes it wants.

The company says it's not interested in making genetically modified people; it wants to alter animal cells used in the manufacture of drugs. New protein-based pharmaceuticals are often made by stewing cells in big vats. The cells produce the desired drug. Chromos can pack those cells with more copies of the gene that makes the drug, so the cells will produce double or triple their natural amount. Or if you're a person with, say, sickle-cell anemia, artificial chromosomes might be recorded with correct copies of the malfunctioning gene and placed in blood-making cells. When the CD is played, your platelets wouldn't be skinny and cockeyed, but round and fat.

"We could modify cells with our chromosomes and have them reside in a dish, a liver, or a muscle and express a therapeutic protein," CEO and president Alistair Duncan says. "That would be very cool."

Indeed, but as cool as that would be, the impact of these near-term applications would make barely a ripple compared with what Stock has in mind: an age of genetically enhanced people. Chromos steers clear of such talk, but, Stock asks, why stop at modifying cells in a vat? Why not engineer disease-free life from the get-go?

Rob and Suzy Ashley couldn't care less about how artificial chromosomes may change the future. But they're supremely grateful for the reproductive technologies available today. When Rob, a NASA engineer, and Suzy, a former teacher, were first married and settling into life in Florida, they never suspected that their union could produce a tragic genetic combination. Unknowingly, both are carriers of Gaucher's disease, and in the roll of the dice that is reproduction, they passed it to their first child, Jared.

Gaucher's disease is a gene-based disorder in which a critical enzyme, controlling the disposal of old blood cells, malfunctions. Some types of Gaucher's can be treated by replacing the enzyme. Jared's could not. The Ashleys' pediatrician first noticed that something was wrong at Jared's six-month checkup. The child's eyes did not quite move with his head. Rob and Suzy had thought that the trait was a cute affectation; they were shocked to hear that he had roughly one year to live. It would be a torturous year. Jared suffered daily throat spasms that left him gasping and coughing, forcing the Ashleys to perform mouth-to-mouth resuscitation two or three times a day to keep him alive.

Technology has pushed the eugenic moment to the point of conception. Now enhancement is impossible to distinguish from treatment.

Then, in December 1997, just two months after Jared's diagnosis, Suzy discovered she was pregnant. "'Give me a gun,' that's how I felt," Suzy says. "It was horrible. I was a nervous wreck. I cried and cried over Jared's crib. I could only pray for Jared. I did not have the strength to pray for another baby."

Suzy decided to undergo a common prenatal test called chorionic villus sampling. Like amniocentesis, CVS can tell a woman whether the fetus she carries has certain genetic diseases. If the test is positive for any of them, parents are faced with a difficult decision.

Such a choice has been available for centuries. The history of eugenics traces at least as far back as the ancient Greco-Roman world, when deformed or weak newborns were often killed. Prenatal testing allows a decision to be made as early as 10 weeks after conception. Most women who test positive for diseases like Down's syndrome opt to abort: up to 86 percent, according to one Boston-area study.

In the end, Suzy and Rob did not have to choose. The CVS was negative, and Quentin was born healthy. Jared died almost exactly a year after his diagnosis. The ability of CVS to prevent such tragedies is why society on the whole approves of prenatal testing, why even people like the Ashleys - both devout Catholics - are willing to consider abortion.

Today, the Ashleys are thinking that they may want another child and have looked into a new screening technology called PGD - pre-implantation genetic diagnosis. This is a test that goes beyond CVS and amnio, looking at embryos before they become fetuses. Here's how it works: A couple undergoes in vitro fertilization to make an embryo in a dish. When the embryo has divided into eight cells, one is removed. The DNA in that cell is then analyzed for known disease-causing genetic mutations. Only embryos that are disease-free are implanted in the uterus.

The Catholic church condemns PGD on the same right-to-life grounds as it condemns abortion, but to Suzy Ashley, at least, there is a big difference between not implanting an eight-cell embryo and aborting a growing fetus. Technology has pushed the eugenic moment almost to the point of conception.

To learn about PGD, the Ashleys called on Mark Hughes at Wayne State University in Detroit, who runs one of the world's top PGD labs. One of only a handful of PGD experts, he screens for single-gene disorders like Gaucher's, cystic fibrosis, and Tay-Sachs disease. Another PGD pioneer, Santiago Munne of New Jersey's Saint Barnabas Center for Reproductive Medicine, focuses on chromosomal abnormalities like Down's syndrome. And then there's Yuri Verlinsky, at Chicago's Reproductive Genetics Institute, whose use of PGD to detect early-onset Alzheimer's disease was featured in a February issue of the *Journal of the American Medical Association*.

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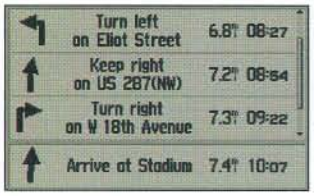

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NASDAQ **GRMN**

Munne, Verlinsky, and Hughes - the three tenors of PGD - account for most of the testing on earth. So far, about 1,000 babies worldwide have been born healthy after receiving the PGD stamp of approval, and the numbers are growing exponentially.

The increase is driven in part by the ability of PGD to ferret out many diseases, even disease propensity. Hughes has screened embryos for BRCA1, one of the so-called breast cancer genes, and for the cancer-suppressing p53 gene.

Furthermore, PGD can be used to make a baby with certain sought-after traits. Increasingly, says Hughes, parents are seeking to match their child's tissue types with that of a sibling embryo, conceived for this very purpose. Some children suffer from diseases that can be treated by transfusing umbilical cord blood from a tissue-matched newborn. This practice gained notoriety in 2000 with the birth of Adam Nash (see "Embryo Police," *Wired* 10.02), but Hughes - who consulted with the Nashes - has been doing it since at least 1995. One of his first cases involved a little girl named Lisa who suffered from SCIDs, the "boy in the bubble" immune disorder. Before taking her on, Hughes sought consultations with ethicists and review boards. Finally, Lisa's impatient father burst into his office. He was fuming. "Our daughter is dying! Give us a break. What's the matter with us loving a new member of our family who can also save the life of our daughter? How could that be bad?" Hughes knew at 4that moment he had to help. Now he handles two or three such cases per week.

"We are responsible for making the world a better place," says one theologian. **"I know of nothing that says God has deemed DNA sacred."**

While ethicists now generally agree that tissue-matching within families is an acceptable use of the technology, there's less consensus on the issue of using PGD to select for sex. Fukuyama opposes gender selection as dehumanizing. Stock thinks it's a non-issue, arguing that most parents don't care about the sex of their babies and that those who do are better off being able to choose the sex they want.

The schism widens further when the discussion turns to the subject of "enhancement" - the use of technology to actually improve the genome instead of merely curing a genetic disease. Stock is in favor, Fukuyama adamantly opposed. This is the crux of the debate: Should eugenics move beyond where it stands right now? Should we take ever-more exquisite control over our evolutionary destinies? The problem is that, while all sides agree enhancement is very close, no one can agree on what qualifies as an enhancement.

Theodore Friedmann works out of a small office next to his lab at UC San Diego. When it comes to the implications of genetic manipulation, he has a reputation as one of the most thoughtful scientists in the field: He holds an ethics chair at UCSD and serves on the government's Recombinant DNA Advisory Committee; in addition, he works with the World Anti-Doping Agency, an investigative bureau established by the International Olympic Committee.

In 1972, Friedmann coauthored a seminal paper in the journal *Science* that proposed the then-radical idea of inserting new genes into people as a way to treat disease. Friedmann was one of the first to worry that gene therapy could be misused. In that paper, he specifically cited enhancement - "the improvement of human intelligence or other traits" - as a danger.

Today, Friedmann worries less: "It's now *not* clear to me that there are these taboos against all kinds of enhancement." In 1972, he says, any kind of enhancement just somehow sounded wrong. But, Friedmann continues, "I don't believe that any longer. Enhancement isn't off the table ... eugenics is a very different kettle of fish from what it was 100 years ago."

Enhancement is inevitable, he argues, because it is impossible to distinguish it from medicine: "There is no sharp division between disease and nondisease traits." For example, one of many ongoing gene therapy trials is aimed at overcoming a mutation that prevents the proper processing of cholesterol. People with this defect tend to suffer from heart attacks in their thirties. A question that Friedmann and others have asked is, what happens if the therapy works so well it reduces a patient's "bad" cholesterol from beyond 100, which is about normal, to, say, 65? Is this enhancement? Could somebody who did not have the mutation but simply wanted to eat rib-eye steaks and still avoid cardiovascular disease undergo the treatment? Is this enhancement? Or is it preventive medicine?

Fukuyama doesn't buy this line of reasoning. Government, he says, makes such distinctions every day. Take Ritalin. It's illegal when used as a study aid but not when prescribed to treat attention deficit disorder. "We need a regulatory system to permit therapeutic uses and go slow on the enhancement ones," he says.

And, he continues, we need regulation, because enhancement is just plain wrong. Fukuyama believes that it betrays human nature, destroying something he calls essence or factor X. Start mucking around with our genes, and we'll lose whatever it is that makes us human. Leon Kass, the chair of the White House's Council on Bioethics, seconds Fukuyama (who also sits on the council), calling the argument "the wisdom of repugnance." Kass' commission, which meets almost every month, is expected to issue its first official findings this summer. The report will address human cloning. For now, Kass, Fukuyama, and their allies have the president's ear.

But there are other voices struggling to be heard. A small but growing faction argues that enhancement is the most human of all instincts. Ted Peters, a theologian at the Pacific Lutheran Theological Seminary, thinks it is our job. He calls human beings "created cocreators." God made us, he reasons, but the rest is up to us. "We humans are responsible for making the world a better place, and technology is one means whereby we can do it.... My approach is a free-market eugenics."

Both Friedmann and Peters see potential dangers, but Peters rejects appeals to the divine plan, saying, "I know of no theological reason why anyone would say that God has deemed DNA sacred."

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Stock, an enhancement radical, argues that we have been tinkering with our own evolution for a long time now. "Every intervention we make that allows a person with diabetes to have a larger family, or to have a family at all instead of dying young, has a big impact," he says. Enhancement technology is no different, except that it would work better and faster. So why not get under the hood of the genome, Stock argues, and fix it - even soup it up - and not just for every new generation, but for all time?

Chromosomes can be wired with on-off switches that permit parents, or the engineered children themselves, to activate the genes they carry.

Stock is proposing a type of genetic engineering in which the changes we make to our DNA are passed on to our kids, and our kids' kids, and so on down the line. But such meddling is so morally fraught that, before any gene therapy trial is approved, the federal government demands assurances that such changes will not occur. The medical consensus is dead set against creating heritable genetic alterations. Genetic experiments affecting somatic (body) cells are OK, but those that affect sperm or eggs - germ cells - are not. Yet here Stock is, advocating germline engineering.

He has been cheerleading for the practice for about five years and has always been a lonely voice. Not only are there practical considerations, such as how to conduct a safety test of a technology that might not play out for generations, there is the ethical question: Should we be making medical choices for people who have not yet even been conceived?

To Stock, germline engineering is no more morally confounding than PGD. "We are making choices about the genetic constitutions of our children right now," he says, "and we are doing it in more and more sophisticated ways. Soon these will include actual genetic manipulations."

Recently, Stock has gotten a lot less lonely. A number of scientists are now willing to talk openly about the idea of gene therapy on embryos or fetuses. As they see it, therapy on embryos could be more effective than postnatal therapy. Gene therapy at that early, embryonic stage would almost certainly create germline changes.

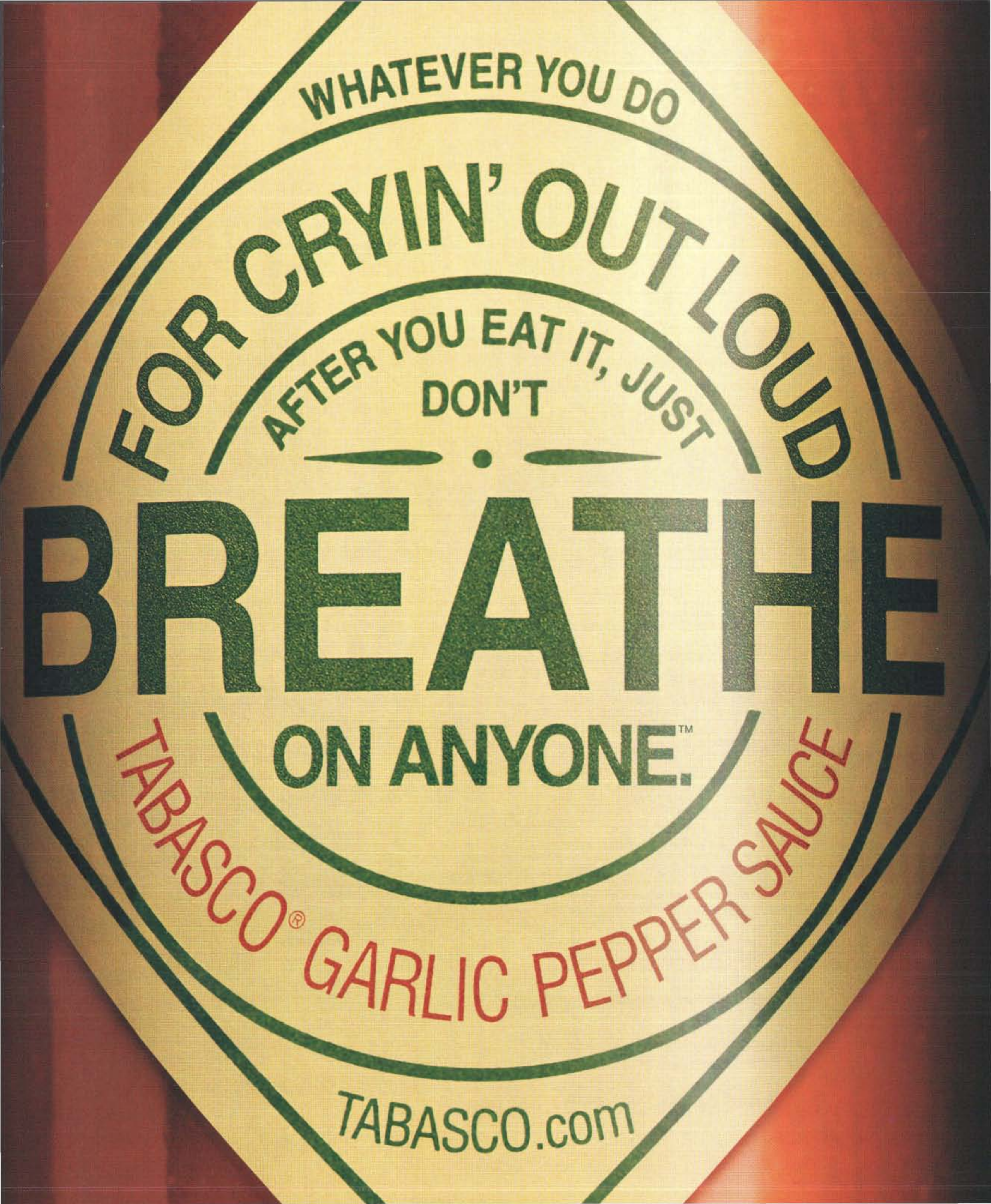
Perhaps the most promising germline engineering technology is Chromos' artificial chromosomes. Not only can they carry huge genetic payloads, they can be wired with on-off switches to permit parents, or even the genetically engineered children themselves, to activate the genes they carry, thus solving the moral dilemma of imposing parental will on the unborn.

Such on-off switches already exist and are routinely deployed in lab animals like rabbits and monkeys. Of course, introducing an extra chromosome could prove dicey. After all, a spare chromosome in humans causes Down's syndrome, though scientists theorize that it's the genes on the extra chromosome that actually produce the defects. Chromos bred a mouse, Lucy, with an artificial chromosome. She passed it to her pups and they, like Lucy, were normal.

It's easy to imagine the possibilities for making genetically modified people, whether with artificial chromosomes or some other technology. A double helping of genes that boost memory, intelligence, longevity, or strength could be on the menu soon. That might seem scary to us. But will it seem scary to our kids?

Could it be that in 20 years artificial chromosomes become the tool that turns us into Ted Peters' "cocreators"? That's what Stock thinks. For him, there's no slippery slope. Instead, he says, we've been on a "slippery sidewalk" for thousands of years, not uncontrollably sliding toward a genetic dystopia but doing what we've always done, whether it's called eugenics or some less-loaded term. "The whole argument against enhancement denies the reality. It's what we want. We want to be healthier. We want to be stronger. We want to be smarter. We want to live longer. It's obvious." ■ ■ ■

Contributing editor Brian Alexander (alexander@pacbell.net) *wrote about the US national standards agency in* Wired *9.06.*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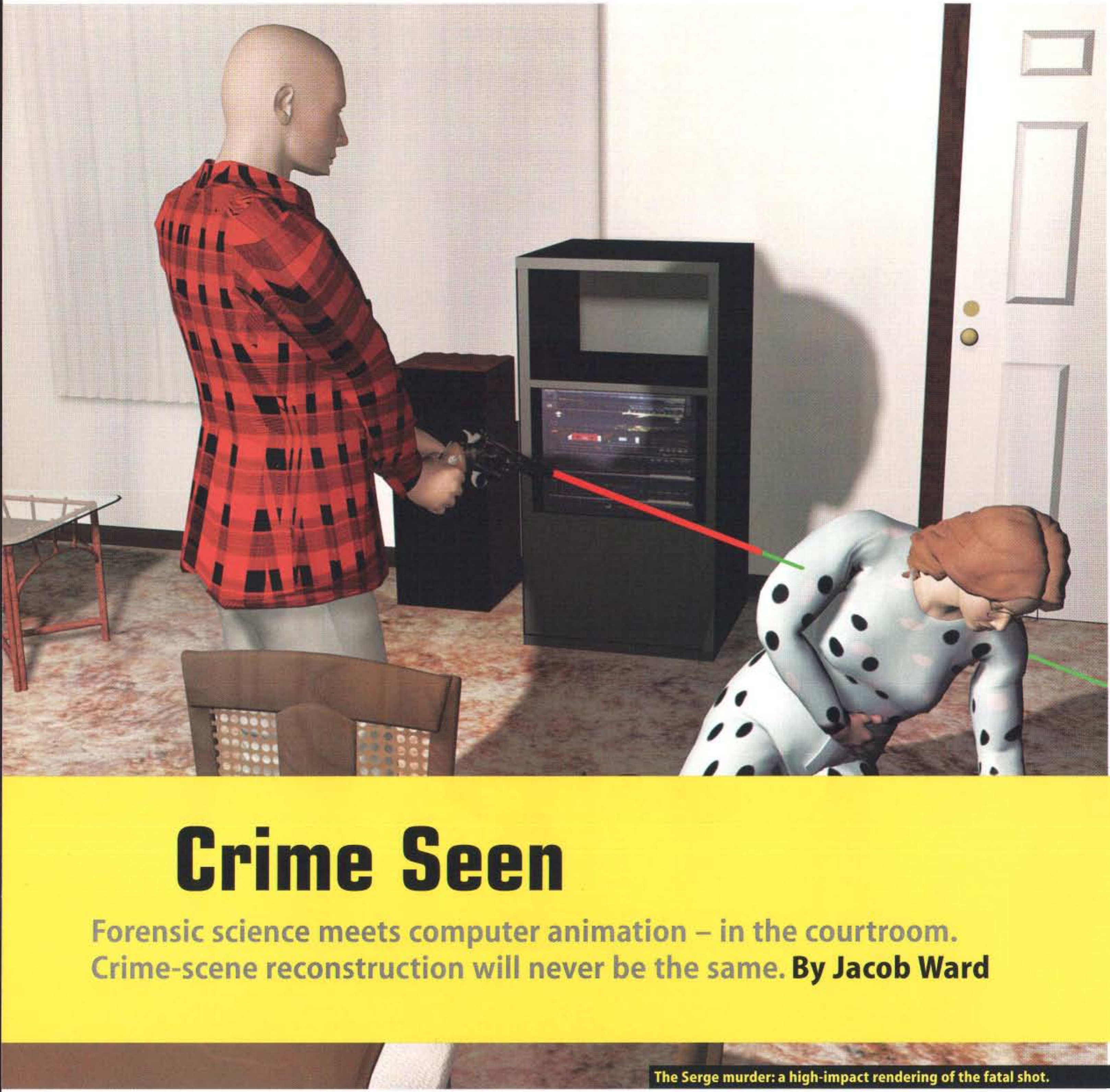

IMAGE: COURTESY 21ST CENTURY

Crime Seen

Forensic science meets computer animation – in the courtroom. Crime-scene reconstruction will never be the same. **By Jacob Ward**

The Serge murder: a high-impact rendering of the fatal shot.

It's 2:30 pm on the fourth day of Michael Serge's murder trial. In a wood-paneled room of the county court house in Scranton, Pennsylvania, Judge Terrance Nealon gives the jury a brief speech on the difference between art and fact, then motions for the prosecution to begin.

At the back of the courtroom, a crowd of onlookers from the local legal community crane their necks as a technician cues up a 72-second video. It's an animated re-creation of Serge, a retired police detective, shooting and killing his wife of 35 years, Jennifer. The picture appears on a 5-foot screen

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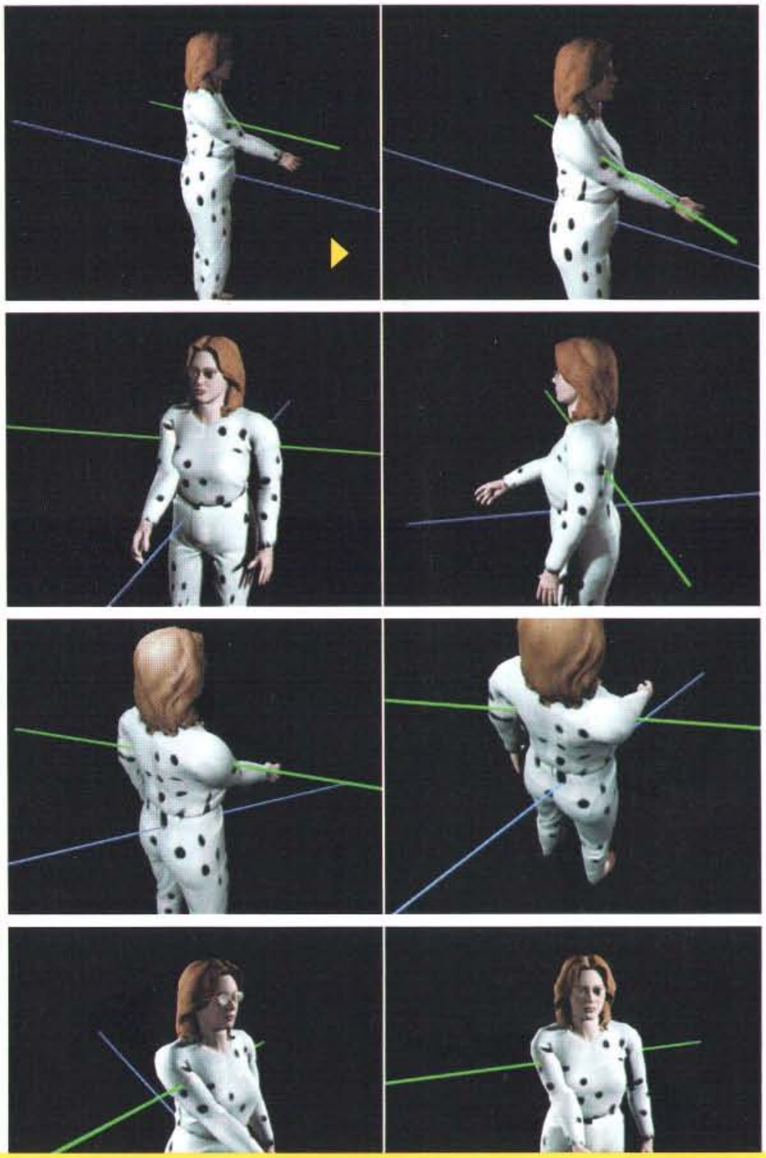
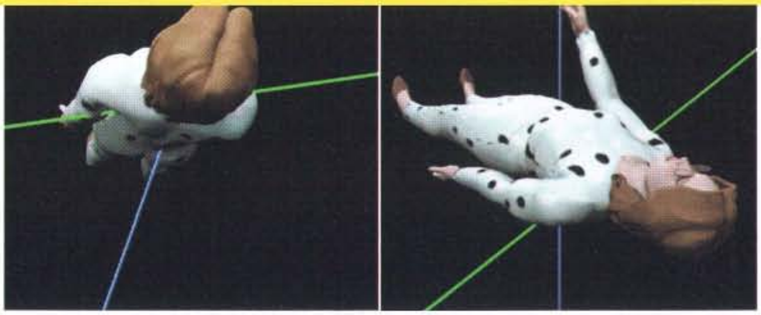




Still frames from the forensic video give multiple views of the shots that killed Jennifer Serge: The first (blue) exited her abdomen, the final (green) pierced her heart.

IMAGES: COURTESY 21ST CENTURY

positioned near the jury box.

The family's living room comes into focus around Serge's wife, realistically rendered with sandy-blond hair and wire-rimmed glasses, and wearing animal-print pajamas. Serge appears, gun in hand. What follows is a second-by-second breakdown of the three shots he's alleged to have fired. First, a bright blue line extends from Serge's gun, leaving behind a frozen rope of red. The blue passes through Jennifer's lower torso and into a stereo cabinet. Next, Serge fires into the wall. In a dramatic ending, he again takes aim at his wife, who is crouched on the floor. The shot pierces her from right arm to left rib in deadly cartoon green. The screen goes black.

Serge, 55, blinks at the digital image of himself. His son, seated behind him in the courtroom, weeps silently. Jennifer's sister clutches a cardboard-backed photograph of herself with the victim. Standing with the spectators is Paul Walker, a local defense attorney, who marvels at the effectiveness of the animation. Walker has worked either with or against most of the lawyers present and happens to be a close friend of the victim's brother. But today, like so many others, he's here just to watch. "I've seen a lot of photos of people lying bloody on the ground," he says later. "But when I saw the animation, it was eerie. If a coroner says the victim had a posterior entrance wound, that doesn't mean anything to a jury. When you see her shot in the back and then down on her knees, that brings it to life."

What the jury saw is known as forensic animation – the computerized illustration of events recounted by courtroom testimony (in this case, the coroner's report and the state trooper's on-scene analysis). It's the newest in a chain of technologies – from lie-detector tests to handwriting analysis and DNA sampling – that is transforming the world of litigation. And while it's nothing more than pixels on a monitor, this legal tool is proving remarkably effective.

"Saying 'posterior exit wound' means nothing to a jury. **When you see her shot in the back and then down on her knees, that brings it to life."**

David Golomb, a Manhattan attorney who has served as president of the New York State Trial Lawyers

Association, calls it "devastating evidence," saying, "If you have a good animation, it's such a difficult thing for the other side to fight."

The first animation was presented to a Bronx jury in a 1984 auto accident case. It was crudely done, with block graphics on an Apple II. Eight years later, the technique was employed in a high-profile criminal trial for the first time and helped convict San Francisco porn king Jim Mitchell of murdering his brother. Over the past decade, as computing power has grown faster and cheaper, forensic animation - used to illustrate everything from baby shakings to product malfunctions - has become increasingly common.

In an age when the courts are clogged with litigation, the acceptance of forensic animation reflects more than the need to find the truth. Judges seem eager to admit any valid evidence that can shorten the duration of a trial. In barely a minute, the jury comes away with information that would otherwise require two days of overwrought oratory. "This is a video country," Golomb explains. "People are used to getting information from the television." In the half-dozen cases in which he has used computer animation, opposing counsel settled almost immediately.

The new procedure has spawned a thriving industry worth about $30 million annually. There are some 100 firms around the country that specialize in forensic animation, not to mention countless studios that create films as well as provide other types of litigation consulting - among the biggest: Engineering Animation, Decision Quest, and Animators at Law.

To make the video as realistic as possible, the animators begin with raw data culled from the site by accident reconstructionists. To get a digital representation of the crime scene, they sometimes use laser-transit survey devices to shoot beams over every inch of the area. "We present everything to one-thirtieth of a second on an x, y, and z axis," says Andre Stuart, CEO of 21st Century Forensic Animation, the company that produced the clip in the Serge case. Then, relying on supplementary data such as photographs, ballistics information, and a coroner's report, they fill in the holes and craft a narrative.

A 3-D animation of even the simplest two-vehicle accident, produced using the fairly unsophisticated CAD program 3D StudioMax, will cost a client no less than $5,000, Stuart estimates. High-end work can climb to as much as $180,000. But even then, this isn't your glossy Hollywood production. Frequently, 21st Century assembles its worlds using libraries of mix-and-match premodeled people, vehicles, and furniture. The company has roughly 25 cases on its docket, and since its inception in 1989 more than 400 clients have retained its services, among them Johnnie Cochran. Cochran hired Stuart's firm in two high-profile cases: Anthony Dwain Lee, the young African-American actor who was shot to death by a Los Angeles police officer in 2000, and Amadou Diallo, the Guinean immigrant who was killed in 1999 by plainclothes New York cops.

The laser-mapped animation is accurate to one-thirtieth of a second, but it's lawyers who craft the narrative.
And changing a single camera angle can mean a multimillion-dollar settlement.

For all of its impact on judges and juries, forensic animation borders on pseudoscience. Consider a typical auto accident. Skid marks, paint samples, and scattered glass yield reliable and scientifically acceptable computer images. Still, much of the moviemaking process comes down to guesswork. How hard did the driver brake? How foggy was the road? As a result, the quest for accuracy is sometimes compromised. Lawyers will often act as executive producers, overseeing the making of the film and calling for changes - in visual tone, for instance - where they believe it may help the case. By changing a single camera angle, Golomb claims he won a multimillion-dollar settlement in a car crash.

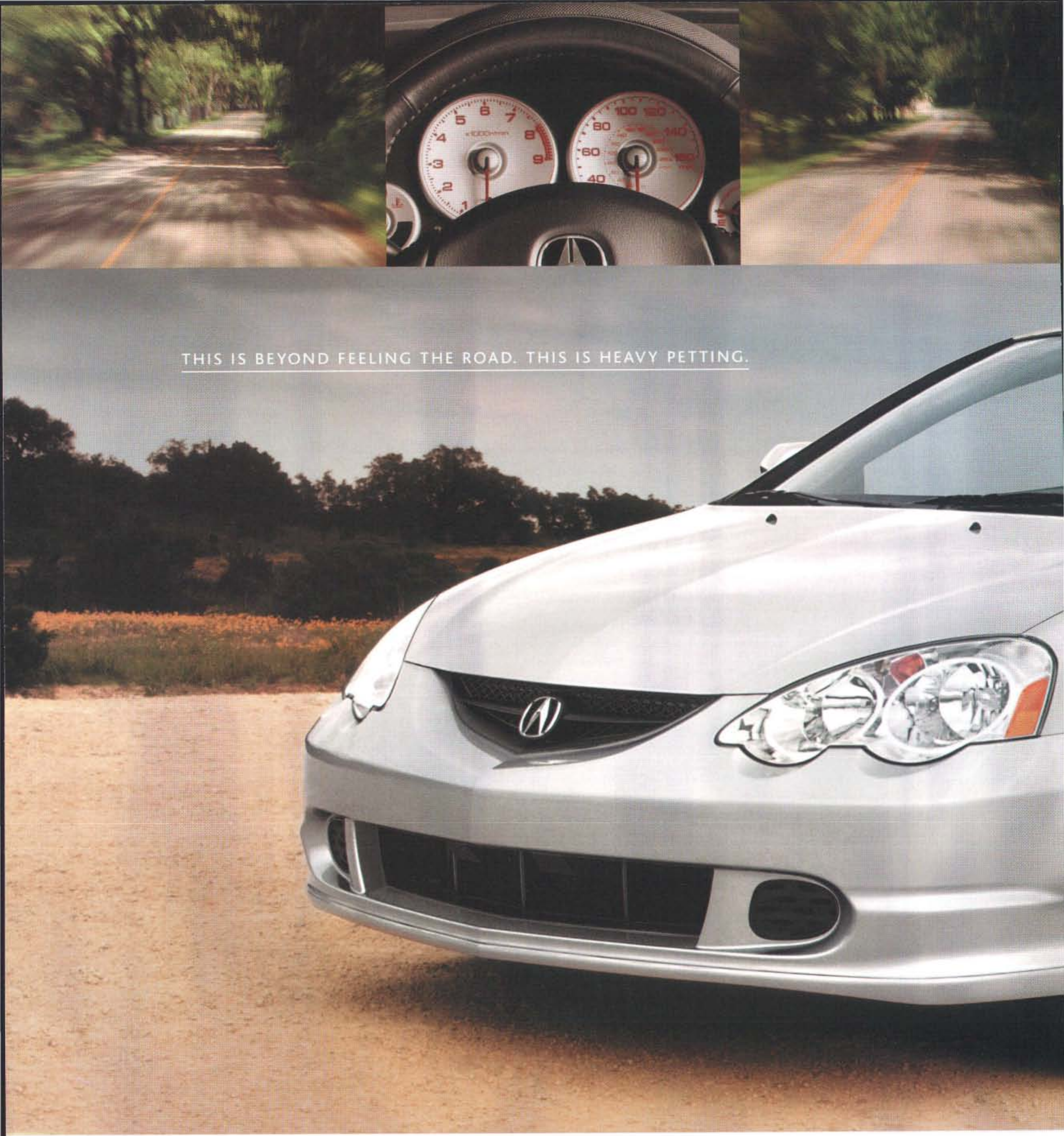
Critics have argued that forensic animation is more prejudicial than illuminating - that it possesses an unjustified ring of truth and may cause jurors to overlook other evidence. Serge's attorney, Joseph D'Andrea, scorned the animation, calling it a cartoon and demanding it be excluded from the trial. He feared its cause-and-effect starkness would inalterably cast his client as a murderer. But Judge Nealon chose to admit it, writing that "an animated exhibit should not be regarded as unfairly prejudicial merely because it enables a party to demonstrate a point more effectively."

The prosecution's decision to commission an animation in such an open-and-shut case had more to do with defining the future than with winning. As the first animation ever admitted into criminal trial in Pennsylvania, it sets a powerful precedent. "We're not known for being trailblazers around here," says Jennifer Henn, a staff reporter for the local *Scranton Times*. "It's amazing the judge allowed the animation in."

Back in the courtroom, the prosecution rests. Walking to his hotel, Randy Matzkanin, a mechanical engineer who managed the animation team behind the Serge case, admits he was nervous at the trial. During a recess the previous day, Matzkanin learned he and a state trooper - the DA's key witness - had miscommunicated about a detail concerning the arrangement of the body in the room. As a result, the video was flawed. "It wasn't inaccurate, strictly speaking," Matzkanin points out, "but it should have been done differently."

A few days later, the jury deliberates for less than two hours before convicting Michael Serge of first-degree murder. Thirty minutes after that, he's sentenced to life in prison without parole. ■ ■ ■

Jacob Ward (jake@jacobward.com) *is an editor at* Architecture *magazine.*



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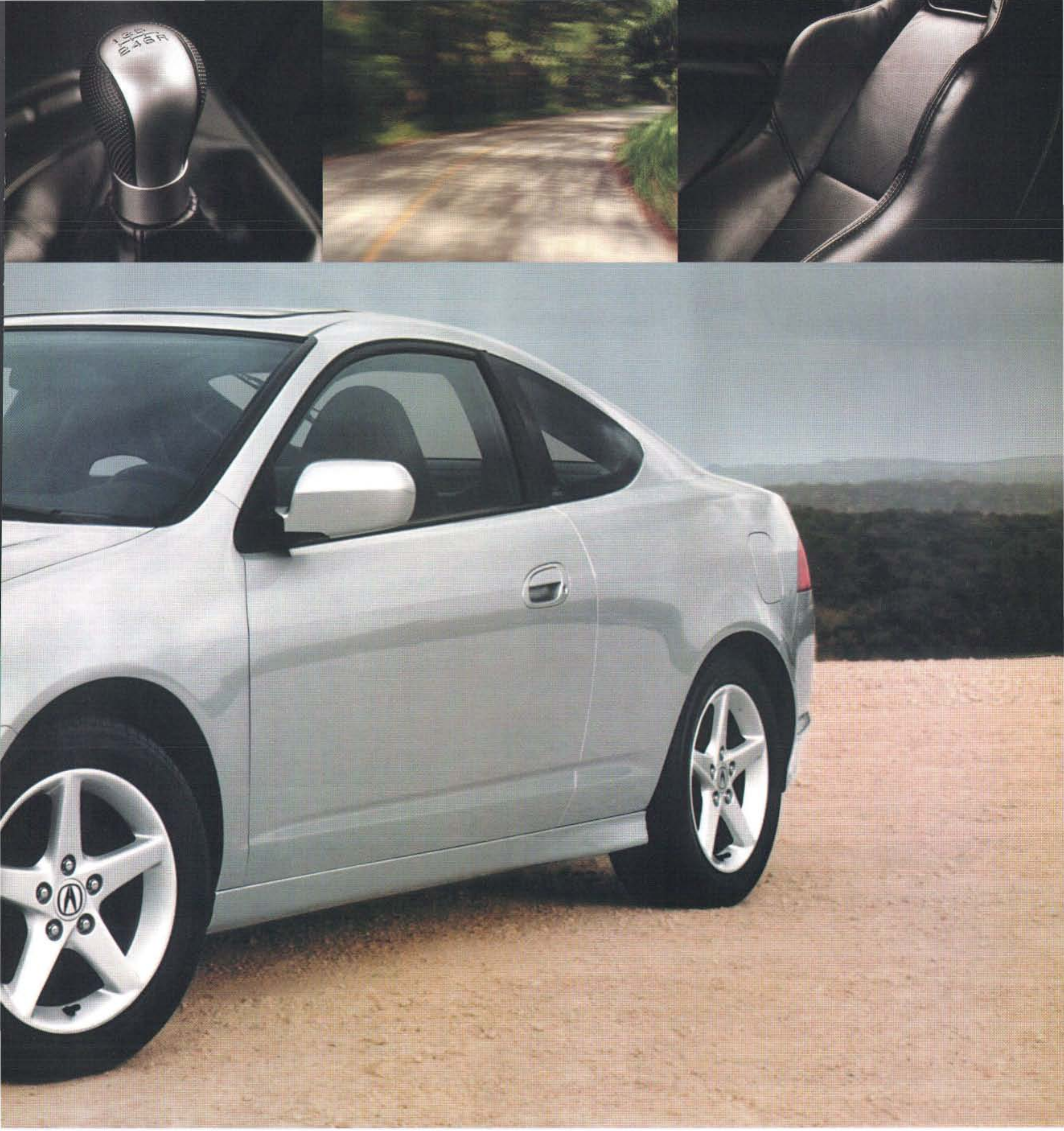

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Playroom, Frank Lloyd Wright's Oak Park Home. Photo: Tim Long

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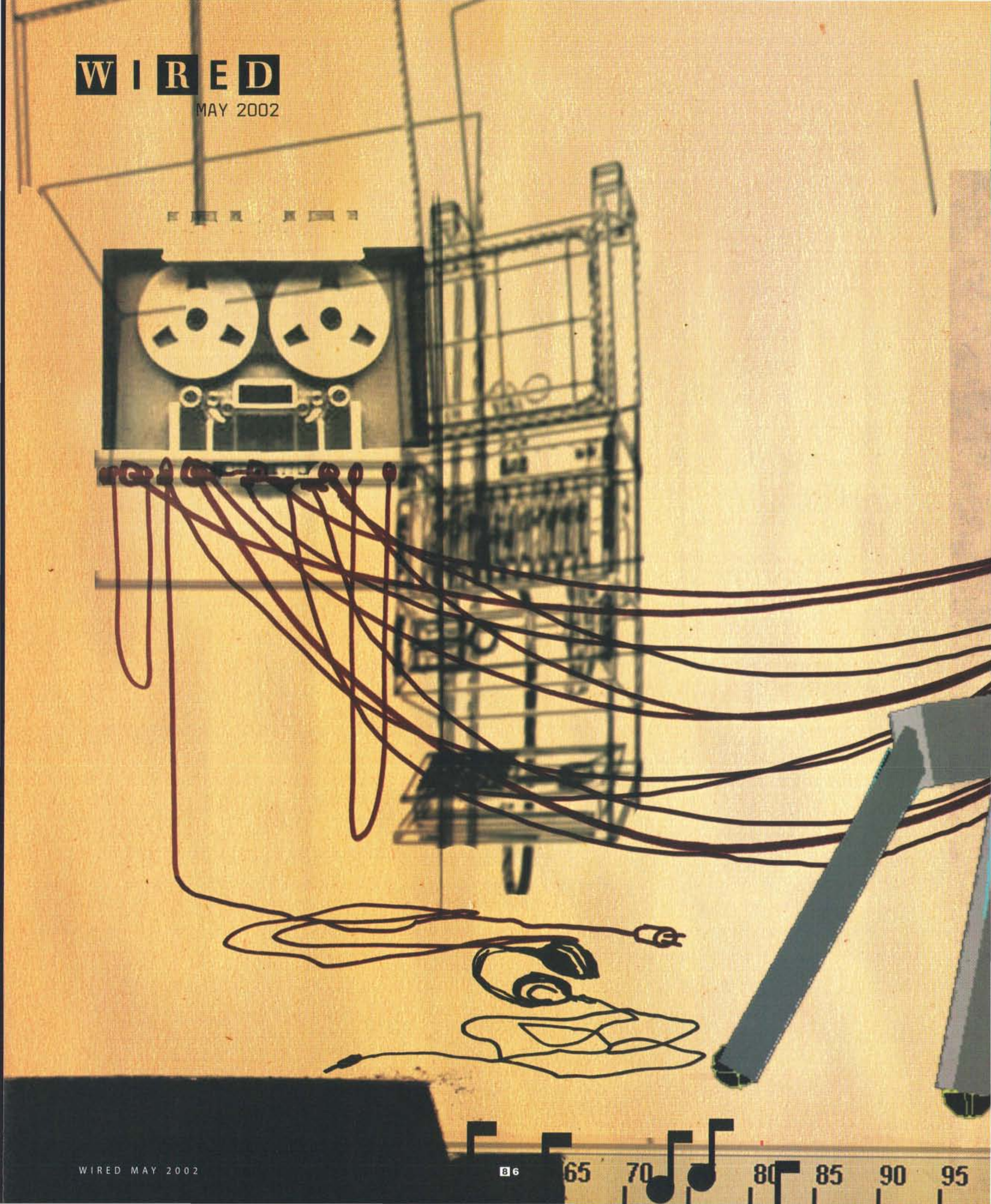
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65
70
80
85
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WIRED MUSIC

At some point, when technology is ready, I will become the machine that I'm using.

– Twerk, "Songs in the Key of F12"

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moby

TECH-SMART, SELF-EFFACING, AND SUPREMELY MARKET-SAVVY, ELECTRONICA SUPERSTAR MOBY ISN'T A COG IN THE MACHINE. HE IS THE MACHINE.

BY ETHAN SMITH

PHOTOGRAPHS BY DANNY CLINCH

EVAN JOSS/SCENE; GROOMER: HEART MONTALBANO;
STYLIST: BRADLEY GARLOCK/JUDY CASEY

STRIDING UP TO A CLUB in New York's East Village, Moby could be mistaken for any of the other 500 fans piling in for tonight's show by rapper Mos Def. Black-frame eyeglasses. Nylon Puma windbreaker. Beat-up blue trainers. He doesn't exactly radiate star power. In fact, you wouldn't even notice the Grammy-nominated musician, except that his unremarkable visage has been a media fixture for the past three years.

Within seconds of Moby's arrival, the concert's harried promoter spots him at the velvet rope and proceeds to make a minor fuss – whisking the techno maestro past security guards, handing over complimentary drink tickets, and thanking him for gracing the Bowery Ballroom with his diminutive presence. Even for the deliberately inconspicuous, celebrity has its privileges.

Inside, some savvy clubgoers recognize the famous fellow in their midst. They're the ones whose lips form a cartoonish circle as they lean toward their dates' ears to observe, "That's MO-by." As old-school hip hop pumps from the DJ's turntables, the object of this attention indulges the approaching fans with as much conversation as the rib-rattling decibel level allows. Moby seems to enjoy these interactions – and why wouldn't he? "It's such a bourgeois conceit to say, 'Poor me, I get to make records that do extremely well, I get to hang out with my friends, and I have to talk to strangers once in a while,'" he says after signing an autograph.

Then, just as he's confessing the truths of stardom, Moby is efficiently elbowed aside by a phalanx of linebacker-sized bodyguards in Bad Boy Records jackets. At the center of the arriving group is Sean Combs – he of the prodigious nicknames and even more prodigious business ventures. Then, as quickly as they materialized, Puffy & Co. disappear into some distant area reserved for Cristal-and-caviar VIPs. Here, meanwhile, stands Moby, out among the hoi polloi, Budweiser in hand. Just the way he likes it.

Thirty-six-year-old Richard Hall, as Moby is legally known, is self-effacing in the most literal sense. Not simply modest, he seems determined to rid himself of identifying characteristics. The shaved pate, the undecorated white walls of his unassuming Little Italy apartment, the stylist-free personal styling. He is – consciously, intentionally – an everyman.

Musically, too, his sound is purposely vague, determinedly indeterminate. By his own account, Moby's music is a patchwork of influences, too diffuse to be likewise influential on other artists. Well crafted but – because of a heavy reliance on borrowed vocals – not especially personal, it's the kind of toe-tapping sonic wallpaper (albeit a high-design *Wallpaper** kind of wallpaper) that works as well in restaurants, aerobics classes, and movies as it does in clubs. This artful universality helped sell nearly 10 million copies of Moby's last album, *Play*. And it will likely drive his new release, *18*, to similar heights.

Even those who've never heard of Moby have surely heard him. "On a purely accidental level," he says, "I have managed to develop my name and self into a brand."

ON THE CONTRARY: It's no accident. Moby is a brand with two carefully crafted elements: The business ventures and the everyman musician who drives them.

Like any proper hitmaker, Moby has incorporated commerce into his creative method. He sells his music to commercials and soundtracks; he sells his likeness – such as it is – to advertisers. Moby's successes on this score have been, in many ways, unprecedented. The dozen and a half songs on *Play*, for instance, have been sold hundreds of times for commercials, movies, and TV shows – a licensing venture so staggeringly lucrative that the album was a financial success months before it reached its multi-platinum sales total. Likewise, as coproducer and creative director of the Area Festival, Moby has helped resuscitate the kind of corporate-sponsored, alternative-music mega-tour first embodied by Lollapalooza. And Moby has made obligatory appearances in Gap ads and mass-market spectacles like the Salt Lake City Olympics' closing ceremonies.

Behind this machine, of course, is the music, music that sounds cool – but not too cool. Which is precisely why it's so appealing: To corporate America, Moby offers an easy shorthand for cutting-edge cachet; the man who made electronica (read: edgy, intimidating, next big thing) safe for the mainstream (read: mass exposure, mass audience, massive sales). As a genre, electronica is long on beats and texture, short on verse-chorus structures or even three-chord progressions. But when Moby gave up his first musical love, hardcore punk, in 1989 for the even more obscure subculture of electronica, he didn't just join the world of knob-twiddlers and session divas. He changed it and made it his own. His version looks backward, incorporating melodies, chord progressions, even entire songs into electronica's requisite beats, bass, and atmospherics. He made it music that sounds both underground and accessible at the same time.

But unlike rock, with its outsize stars and stage-show theatrics, electronica is a peculiar breed of music, one that emphasizes anonymity, aliases, and intermediation. Anonymity because the music amalgamates bits and samples from others' work

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Ethan Smith (ethansmithny@hotmail.com) *writes about music, business, and culture.*

WIRED MUSIC

Beat Manifestos

Musicians sound off on their fave tech toys and the future of music.

BJöRK

On my last album, *Vespertine*, I became obsessed with my laptop and my laptop speakers: I was trying to make a bubble you could exist in, a paradise.

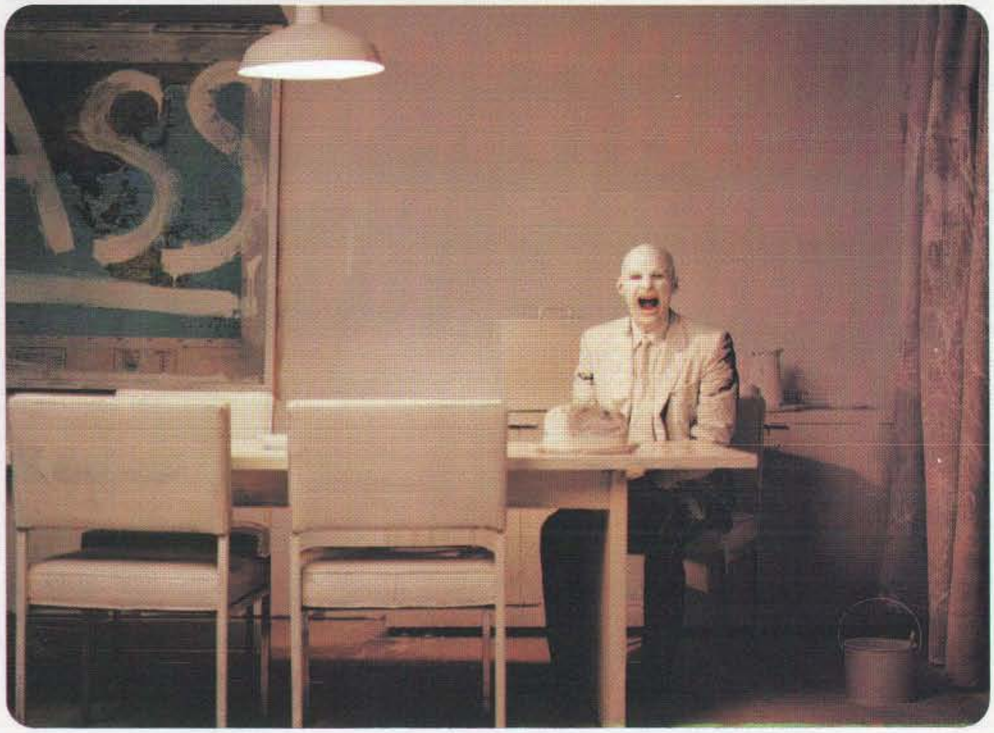
For the string and music-box arrangements, I used a classical program called Sibelius, where you have all the instruments of a big orchestra in a laptop. You get a picture of sheet music and a mouse that operates as a pencil, so you write it out and press Play, then print it and hand the music to the orchestra.

I recently got a thing that's become a favorite called MOTU 828. It's a firewire rack that replaces the soundcard, which means I can plug my microphone straight into my laptop, and it's got the best recording quality there is.

A gorgeous thing is happening now as technology becomes more common. It's like years ago, when there was a piano or guitar in everyone's home and everybody would know how to use them. It's excellent, because if one's human spirit wants to write a song, it's more likely to be captured now. Good music always wins.

PHOTOGRAPH: RETNA

THE MAN, LIKE THE MUSIC, IS COOL – BUT NOT TOO COOL. HE IS CONSCIOUSLY, INTENTIONALLY, AN EVERYMAN.



into something (mostly) new. Aliases because when identity happens, it's all about assuming a new one: DJ Shadow, Tricky, Aphex Twin. (Moby is no exception, from his old Voodoo Child alter ego to the tag "Moby" itself.) Intermediation because it's all about using the right machines to find the right sounds – a process that inevitably abstracts the person behind the keyboard. (Moby embraces that process more than anyone: Even when he does sing, his voice lacks identifying characteristics.)

Moby became one of the few name-brand stars in that rarefied world thanks largely to his underground 1992 hit, "Go." With 1999's *Play*, Moby made the leap to bona fide, recognized celebrity – the first (Fatboy Slim notwithstanding) to make it from techno DJ to superstar.

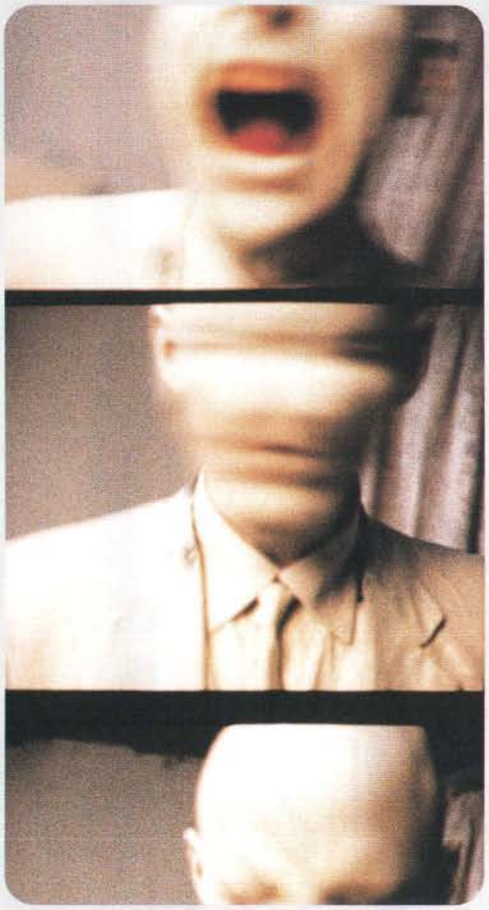
Moby might prefer his fortune to seem a matter of happenstance, but it's not. Indeed, only by strategically leveraging his ambiguous looks and music has the lone DJ become a diversified corporate concern. For Moby, even casualness is a construct. Read Moby's Web site, *www.moby.com*, and you'll find a regular guy who, say, gets bitten by stray cats like anyone else. But that same lackadaisical guy is the star who talks openly about the burdens of being the breadwinner for two labels.

Some 50 years ago, urban sociologist William Whyte introduced the term Organization Man to describe the anonymity of corporate existence. Moby's self-effacement calls this state to mind. He's got the same impulse toward isolation, the same reliance on other authority for his work – whether it be Alan Lomax or Gwen Stefani. "Only as he collaborates with others does he become worthwhile," Whyte wrote of his Man, "a whole that is greater than the sum of its parts." The same could be said of Moby.

But Moby's Organization builds on Whyte's; Moby takes Whyte's vocabulary and synthesizes it into a 21st-century, post-capitalist argot. Where Whyte's Man was a cog in the machine, Moby is the machine. Moby is the Organization. He has turned the corporation to suit his own particular taste – and is selling it for $13.88 in Wal-Marts nationwide.

And yet somehow, Moby sells himself without selling out. Even as Microsoft and *Dharma & Greg* were capitalizing on his ear for pop hooks, reviewers were gushing over *Play*. Shortly after the LP's release, critic Robert Christgau raved about "the Moby album we've been waiting for." He also predicted that while the disc was "some kind of hit in England, here it'll be strictly for aesthetes." Christgau's forecast was a bit off the mark: Not only did *Play* sell itself to the masses – it could be used to sell pretty much anything else to them, too.

"I THOUGHT *Play* might sell 200,000 copies worldwide," Moby says. "And that was the absolute upper limit." At the time he was recording the disc, that appeared to be the commercial reach of his sound, and it was still enough to make him one of electronica's three or four biggest success stories, alongside the Chemical Brothers and Prodigy. Electronic music was still essentially a fringe sound familiar to clubgoers and hipper-than-thou indie types; it hadn't truly broken out. Television ads were an important exception; the creators – who spent their days on Madison Avenue and their nights at clubs like Vinyl and Centro-Fly – recognized the commercial potential of Moby and his techno peers long before radio programmers did.



That was the masterstroke in marketing *Play* – the licensing of all 18 of its tracks, from the technofied down-home blues "Honey" to the muted rock anthem "South Side," for use in advertisements, TV programs, and movies. Moby offers a soft-focus view of how this all happened. "That was just, like, taking advantage of an opportunity," he says. "There was no strategy involved. They called us up and said, 'Can we use your song in this commercial?'"

Moby's managers, Marci Weber and Barry Taylor, offer a decidedly different account. Even before the release of *Play*, with its record-setting run of commercially licensed songs, Weber says the strategy was core to the Organization. In 1996, for instance, they received reports that Moby's atmospheric "God Moving Over the Face of the Waters," which sustained the climactic scene in Michael Mann's *Heat,* had made an enormous impression on the film-music community. So during that year's Slamdance film festival, Weber and Taylor "invited every music supervisor in Hollywood" to a party to increase their client's visibility. "We put on this free show, big dinner, all that." Certainly *sounds* like a strategic soiree. Indeed, when it came to selling Moby's music to soundtracks, Weber adds, the event "was a breaking point."

With *Play*, three years later, the managers took the formula and turned the album into an industry. They had seen Moby's first three major-label albums ignored by radio and *Play* rejected by record company after record company before being picked up by indie newcomer V2. (Moby parted amicably with Elektra after his second effort for the label.) Clearly, the music industry's version of business as usual wasn't working out for him. So, says Taylor, "we made a conscious effort to create a marketing plan that had nothing to do with radio."

Hundreds of phone calls and faxes later, all but one of the songs on *Play* had been "exploited," as music-publishing vernacular puts it. "Porcelain" tinkled away for Bailey's Irish Cream and Nordstrom; "Find My Baby" was hooking hipster consumers for American Express.

On April 20, 2000, almost 11 months after the album's release, the producers of a British television program faxed a request to use the one album track that hadn't been licensed. No one had actually expected "7," a brief, unremarkable bit of incidental music, to be bought. When the fax arrived, says Taylor, "we celebrated."

Taylor isn't, of course, expecting sheer momentum and goodwill to get the job done with *18*. As a V2 promotion executive hovers in Moby's managers' offices, the air is thick with the vocabulary of modern marketing: Cool Kids. Adult Triple-A Types. Underground Tastemakers. It was *Play*'s eager reception from all these demographic groups that made it such a hit, and the business types are intent on getting them to buy again. "There's a percentage of people who bought *Play* because they heard it at the gym," V2 president Andy Gershon acknowledges. "Part of our job now is reaching out to those people and turning them into Moby fans."

Moby's people say he's become enough of an FM staple that they can rely on several radio formats to get on board for *18*. That in turn means that the innovative licensing machinery that propelled *Play* will be put on hold. "We're not going to call Volkswagen and say, 'OK! We've got the record!'" says Weber.

"We don't have to," adds Taylor. "We can be a little more precious with the licensing." For now, they're not saying what that means, exactly. They haven't ruled out licensing songs, but they're not following the *Play* playbook either: No advances of *18* went out to soundtrack supervisors. They'll have to wait till May 14 like everyone else.

LITTLE ITALY is turning into NoLita on the gentrified block where Moby has lived for the past decade. Wealthy shoppers buy designer spectacles and French bonbons at a boutique called Lunettes et Chocolat. David Bowie lives across the street. But inside Moby's five-story building, there's still the feel of the neighborhood's gritty past. The hallways are battleship-gray concrete, and there's some requisite graffiti – drawn by Moby himself – in the elevator.

It's plausible that Moby hadn't expected to become a star; he certainly doesn't live like one. Though his loft is airy, with high ceilings and several skylights, it's small, probably not much more than 1,000 square feet. The brick walls are painted a shade that calls to mind Ralph Ellison's phrase "optic white" – a hard, unforgiving hue unrelieved by artwork.

The only fully separate room is Moby's recording studio, a fastidiously organized, double-walled space filled with winking LEDs, racks of keyboards, and a pair of Macintosh computers – a G3 and a G4 – on which he composed *18*. The G3 runs the dozens of MIDI keyboards, samplers, and drum machines lined up on the studio's custom-built shelving. The new G4 records and manipulates vocals and live instruments (Pro Tools, the Word of the music-production world, is his basic software).

Before he began work on *18*, Moby hired friends of friends to scour thrift stores in New York, LA, and London for records he could mine for samples. "Anything," he says of the kinds of music he was looking for. "French. Malaysian. American. I didn't care. I just wanted voices." The hundreds of LPs that poured in are now tucked out of sight in rows of cabinets.

Last spring, as Moby was thumbing through these albums, he began writing and recording songs (when done by computer, he says, the two processes are largely indistinguishable). Unlike some musicians who hesitate after a major blockbuster like *Play*, Moby dived in. He composed batches of songs, sending discs labeled, numbered, and dated in Magic Marker – "Moby Ideas 2, August 2001," "Moby Demos 3" – to his managers and his A&R rep at V2. Within 10 months, he'd sent a startling 35 discs, comprising more than 140 songs – enough to fill their own shelf in Taylor's office and to prompt thoughts of a triple CD. "Thank goodness everyone – my managers, my friends – said, 'That's the stupidest idea we've ever heard,'" he says.

A few days after his brush with P. Diddy, the apartment's lone occupant is sitting at his brushed-steel laboratory table, tucking into a dinner: brown rice, tempeh, and, for spice, sesame seeds. He's still pondering the Mos Def show, where he was, it turns out, doing research for Area:Two, the multigenre package tour he will produce and headline this summer. The event is a follow-up to last year's Area:One, a tour that included acts like Nelly Furtado, OutKast, and New Order and was sponsored by Ford and Intel, among others. Moby oversaw the tour both as a creative director and a coproducer, along with Taylor, Weber, and concert and radio titan Clear Channel/SFX.

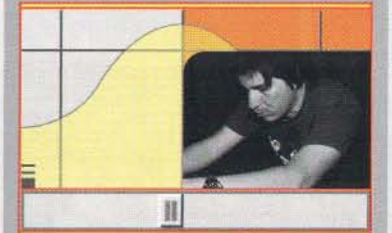
Such propositions have a mixed history. The pioneer, Lollapalooza, ran for seven years before it collapsed in 1997 under high costs and a lack of direction (founder Perry Farrell has announced Lollapalooza's resurrection this summer). Of the other multi-act events that Lollapalooza inspired, as many have gone under (H.O.R.D.E., Lilith Fair, Enit) as have survived (OzzFest, Warped, Family Values). The rule of thumb seems to be that the more eclectic the tour's roster, the poorer its prospects – a red flag for the diverse Area festivals. Still, Moby's not daunted. The 16-stop Area:One grossed about $7.5 million – not enough to break even, but close enough to persuade Clear Channel to sign on for this year's Area:Two.

As for Mos Def, from an artistic standpoint Moby found himself "completely underwhelmed" by the tired funk-metal churned out by his backing band – so much so that he left the club after two songs. But his commercial sense corrects him: The place was sold out, and the young, racially diverse crowd *did* seem to be enjoying themselves. "It could work for us," he muses.

Moby's all about being less judgmental these days. That Bud he was enjoying at Bowery Ballroom? A few years ago, he wouldn't have touched it – he hadn't done so, as his early press coverage reminded fans repeatedly, since going straightedge at age 15. "For a long time I felt superior to everyone else," he says. "Because I was a vegan, and 'cause I didn't drink, and 'cause I didn't sleep around, and 'cause I listened to dance music. It all made me feel arrogant and superior." Then one day, after a bitter breakup with a girlfriend, Moby found himself consumed with the need to get outside himself temporarily. Soon, he was getting drunk with friends and asking himself, "Why was I so judgmental for such a long time?"

PLAY'S MARKETING PLAN ROUTED AROUND RADIO ALTOGETHER. A RECORD-SETTING RUN OF COMMERCIALLY LICENSED SONGS TURNED THE ALBUM INTO AN INDUSTRY.

PEPE MOGT (Nortec Collective/Fussible)



We started using sequencers on computers about 13 years ago. We weren't even using Windows, just straight operating systems like DOS.

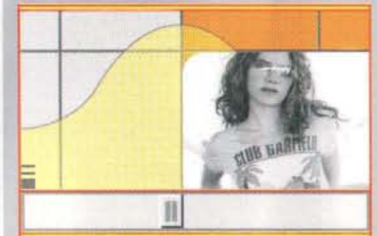
Ten years ago, I was working with a sampler that had only 1 megabyte of memory. Now I have one that has almost unlimited memory. That's insane. But it's good to have the old school, because sometimes, when you limit yourself, you can become more creative. Technology has a way of making people lazy.

I have different toys I like. I work with hardware instruments like drum machines that I build myself. One of my favorite software gadgets is called Live, made by Abelton of Germany. It's an audio sequencer that allows you to sample your software instruments and assign all the keys on your computer keyboard to trigger all the samples, so you can create a track on the fly. The other one, which will revolutionize music for DJs, is called Final Scratch. You can record your vinyl and MP3s on the computer, then connect the interface to your turntables. And you can put physical vinyl on the turntable: It has a digital code that triggers the MP3 on the computer. Both will be the big thing this year and in the future.

PHOTOGRAPH: COURTESY PEPE MOGT

> "I WAS JUST BEING AN UPTIGHT PRICK," HE SAYS OF HIS STRAIGHTEDGE PUNK PAST. THEN HE REALIZED HE COULD PISS PEOPLE OFF WITH SYNTHESIZERS.

NIKKA COSTA



Since I'm a singer, my favorite tool is the microphone. A microphone is an instrument in and of itself, different ones that go well with your voice and different ways of using it to make yourself sound a certain way.

Technology is making the creative process full of options. There are so many ways you can make music now; you have a million and one things you could do, which doesn't necessarily make it better.

Now everyone uses computers and programs like Logic and Pro Tools to make records in their home studios, which is still pretty new. It's so at-your-fingertips. Everyone has the ability to make a whole record – not just demos – that will actually be played. I've got a whole studio setup at home based around computers, though I use real amps and instruments combined with the computer-generated stuff.

Technology is changing music sonically – instead of a band in a room with some mikes, it's a lot more digital sounding. Everybody and their mother uses technology to mix old music samples with new music. The difference is *how* you use it.

The uncomfortable conclusion lingered long after the cosmopolitans had worn off. "I was just being an uptight prick," he says, sounding like a member of Uptight Pricks Anonymous. "I didn't spend every waking minute being an uptight, judgmental prick – but I definitely had those tendencies."

Such hardheadedness had artistic implications, too. When he first embraced electronic music, he says, he did so to be contrary – to punk rockers, trappings like drum machines, synthesizers, and dance beats were still tainted by the "disco sucks" stigma of the 1970s. "Ninety percent of me just loved the music," he clarifies. "But then the fact that I could also piss people off with it, that was satisfying, too."

By 1994, the mainstream music biz had taken an interest in electronica, and the hunt was on for the genre's Nirvana. Moby was the most likely candidate, and he signed with Elektra Records.

Looking back, Moby calls his first album for Elektra, *Everything Is Wrong*, "beautiful but confrontational." While the disc featured some of the elements that would make *Play* such a hit – recognizable, accessible song structures and catchy sampled vocals – it had a sterile, too-pure slickness. For his second big-league effort, *Animal Rights*, Moby gave up almost entirely on electronic music, opting instead for hard rock – a commercial, critical, and artistic failure that left fans feeling abandoned and newcomers indifferent. "I wanted to make a really difficult record," he says now. "I got it out of my system."

With *Play*, Moby says, he was finally making the album he *really* wanted to do. He almost talked himself out of including the wildly catchy "Honey," which would become the first hit from the record. "It was such an obvious idea," he says of the song, which grafts a sampled blues refrain over an insistent 4/4 house beat. But "Honey" was the right song for the times – just techno enough to get clubgoers' feet moving; just catchy and approachable enough to wend its way to number one on the UK charts.

In the US, *Play*'s success grew slowly by word of mouth and a gradual, wary acceptance on commercial radio, moving from a club album to a hipster favorite to an MTV and Top 40 staple, ultimately staying in the Top 100 for 14 months. Finally, electronica had its *Nevermind*.

Which creates significant anticipation for *18*. It will be, for millions of listeners, Moby's second album, not his twelfth. That worries executives at the artist's two labels, V2 and Mute. They don't want familiar production techniques that would make him seem like he was stagnating – or, worse, rehashing a formula. "It was a serious issue," Moby admits. "We had arguments. They didn't want me to have any songs with sampled vocals on them. They were like, 'If you make a *Play 2*, people are gonna criticize you.'"

There's no getting around it: *18* sounds, almost track for track, like *Play*. It even has the sampled gospel vocals – though in place of the earlier disc's rusticated "Ooh, Lawdys," *18* features more urbane, sexy-sounding shout-outs to the Almighty. Moby insists the echoes are essentially coincidence. "I want to make a good record," he says. "And if it means it has songs similar to things on *Play*, fine." It is a good record – and if *Play* hadn't existed, it would be a great record.

But if *18* is artistically safe, that may be because there's a lot more riding on it. Thanks to *Play*'s success, Moby is now a far bigger moneymaker than any other artist on V2, his US label, or on Mute, which handles his distribution in the rest of the world. Ditto his managers' firm. That effectively makes him responsible for the dozens of people who work at all three companies. "I never aspired to be an industry," he says. "Sometimes I'll become aware of that, the weight of it – and I'm just one guy."

IS ORGANIZATION MOBY a model for other superstar musicians? Probably not. Few have an opportunity to ride a wave into the mainstream the way Moby has. Not to mention that the club of multi-platinum artists simply isn't that big, and the selling process turns most of them into bland multi-mediated concerns ('N Sync now offers its own brand of prepaid phone cards). If Moby's success is a textbook example of self-creation and positioning, it's not the same sort of self-incorporation as, say, Madonna, whose transitions always offer a different image of her – from slut to vamp to cowgirl. Even Moby's de rigueur turn as celebrity restaurateur has a self-deprecatory quality: Opening soon on Manhattan's Lower East Side will be his own cozy hot-drinks joint called TeaNY. Pronounced *teeny*, the place has modest ambitions, Moby says – "just lovely" food in "the cutest little space."

In this and other ways, Moby is doing the superstar thing on his own terms. "This might seem strange, because not many musicians say this, but I'd rather make a record that's rewarding than challenging," Moby says. "People love their favorite records. And I aspire to make a record someone might be able to love in that way," he says. "I like the idea of playing concerts people actually come to. That's about it."

Like so much with Moby, there's more to it than that. It's not so easy to sell club music on an arena-rock scale. But for Moby, everyman and superstar, it's just another day at the office. ■ ■ ■

PHOTOGRAPH: RETNA

Songs IN THE KEY OF *F12*

FIRST SOFTWARE TURNED THE LAPTOP INTO A MUSICAL INSTRUMENT. NOW WHO'S IN CONTROL: THE MACHINE OR THE MUSICIAN?

BY ERIK DAVIS

Kid606, live in Berlin, plays dual PowerBooks and a crossfader instead of the traditional wheels of steel.

PHOTOGRAPH: ALEXANDER KURZ

IT'S SUNDAY NIGHT at Open Air, a small, sleek lounge in downtown Manhattan. A couple dozen musicians, DJs, and bedroom hackers huddle around the bar or relax on couches. Many are toting computers. The atmosphere is trendy but soothing: Exposed wood conjures a California vibe that counterbalances the space-station chill; sunsets and moonscapes float across a wall of flat-panel displays. Everyone's paying more attention to their laptop screens than to the art on the walls – making the scene more home-brew computer club than East Village bohemia.

Everybody's here for Share, a weekly gathering that began last summer as a swap meet focused on the applications, macros, and plug-ins available to musicians working with PCs. Most of the goods were soon traded, and the party evolved into a combination jam session and mutual support line. Share co-honcho Rich Panciera, a scruffy Brooklynite who records under the handle Iloop, explains: "The music people play here is a prototype for the music of the future."

Keiko Uenishi jams at Share, a monthly software swap meet in NYC.

The music, as you might guess, is electronica. And though the stuff at Share sounds rather avant-garde, with its edgy textures and squirrelly beats, it's also strangely familiar. After all, electronic music is ubiquitous these days, the sonic backdrop in restaurants, retail shops, and TV commercials. Its signature moves are used by everyone from Timbaland to Radiohead, Björk to Moby.

In a larger sense, nearly all of the music you hear today, both recorded and live, is electronic. This doesn't necessarily mean that it's digital – many studio engineers and artists remain fervently attached to analog hardware, with its arguably greater warmth and richness. But the computer is inextricably woven into all stages of the modern recording process: Even acoustic music such as string quartets and bluegrass is spliced and diced with all-purpose mixing software like Pro Tools and Logic. The wandering tones of mediocre (but marketable) singers are routinely treated with pitch-correcting programs like Antares Auto-Tune. And no one balks at drum machines anymore.

Most mainstream music production relegates the computer to a behind-the-scenes player. The digital processes that help create the sense of presence and authenticity are smoothed out and kept in check. The Share crowd wants to let those techniques loose. For them, the PC is no longer simply a playback device or an inexpensive home studio. It has become an instrument in its own right.

An explosion of scattershot beats emerges from the next room. The sounds belong to Geoff Matters, a slight 24-year-old who sports a wispy Fu Manchu, earrings, and long blond hair stuffed inside a beige stocking cap. Besides helping to organize Share, Matters is one of the lead programmers for GDAM, which stands for Geoff and Dave's Audio Mixer. An open source digital DJ rig that's "perpetually in beta," GDAM cuts and mixes MP3s like a vinyl DJ gone cyborg.

Matters unfolds a 4-foot-square mat that looks like a ticktacktoe gameboard and has the phrase STAY COOL! emblazoned in the center. Officially, the device belongs to *Dance Dance Revolution*, the PlayStation version of an insanely popular Japanese arcade game that leads players through hyperactive dance routines. Instead of dictating moves, Matters' rejiggered pad lets him drive the music. Stepping on different squares controls an array of beats and effects, allowing him to scratch virtual records with his feet. "It's not about re-creating vinyl," Matters explains. "It's about performance."

As Matters hops around in his fat, floppy socks, the evening's featured performer settles down on a nearby couch and pops open her PowerBook. Keiko Uenishi, aka O.blaat, is a Japanese artist best known for wiring up Ping-Pong games with mikes and modulating the resulting audio. Without fanfare, she begins unleashing an enchanted sea of sound: Fuzzed-out birdcalls flit through submarine drones, and scratchy beats crackle like a thousand records skipping as one.

Uenishi's set is great; however, like most laptop musicians, she's boring to watch. Calling up audio files and filters with a QWERTY keyboard lacks the visual punch of a guitar solo or a drumroll, and often there isn't even a visible link between a keypunch and a specific change in sound. Is it live or is it Memorex? No one at Share seems to care, and for all I know, Uenishi might have spent her time playing *The Sims*.

The question about the "liveness" of the show conceals another, more difficult one: Who exactly is responsible for the music? Both at the club and beforehand, Uenishi made any number of decisions about audio files and sequences. But the PowerBook and its software brought it all together and unleashed the flow in real time. Who's in control? The machine or the musician?

We should be used to this sort of ambiguity by now. Remix records regularly outsell the originals, rap music rules the charts with repurposed

PHOTOGRAPH: LUCAS THORPE

samples, and Black Sabbath uses TelePrompTers onstage. These days, Milli Vanilli seem like prophets, not cheats. As the musicians adapt the computer, the distinction between the instrument and the music the instrument makes begins to break down. Uenishi wasn't joking when she suggested to me that, in the future, the pop chart would become a software chart.

THERE ARE LOADS of digital instruments available, but most don't create new sounds – they emulate old ones. Techno kids who once drooled over rare or expensive hardware like Prophet-5 or DX7 can now download "soft synths" from the Net (legally or not). A popular Swedish product called Reason serves up a bevy of virtual machines in an old-school package: Boot the program and you see a rack-mounted stack of rectangular boxes equipped with the old knobs and sliders. If you want to reconnect the devices, you can just spin the simulated machines around onscreen and switch the patch cords.

The hardcore, however, use more flexible applications that let them design their own instruments directly. The most legendary of these modular programming environments is Max/MSP, which got its start 20 years ago at Ircam, a highbrow music research lab in France. Max allows users to design data-flow networks that, among other things, can generate music. MSP is an extension to Max. It synthesizes and processes the sounds sluicing through those networks. Max/MSP creates these networks, called patches, mostly by drawing links between graphical objects that represent different processes. "It's like a musical Erector set," says Joshua Clayton, a Max programmer who records under the name Kit. "From simple building blocks, you can build individualized musical machines."

Max/MSP's lean packaging and steep learning curve restrict users to a rather elite group of coder-musicians: Some – Aphex Twin and Autechre, for example – are electronic pop stars, but most are buried in academia. The company that sells the program, Cycling '74, keeps a low profile, with only a handful of employees, little advertising, and no outside investors. As Cycling executives see it, high-end software like Max/MSP will never become more than a cottage industry that caters to serious electronic musicians, who are often demanding, idiosyncratic, and poor (and hence are sometimes willing to swap cracked software).

Contributing editor Erik Davis (erik@technosis.com) *wrote about* The Lord of the Rings *in* Wired *9.10.*

PHOTOGRAPH: RETNA

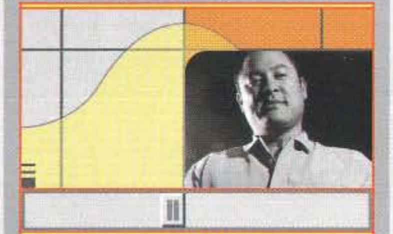
A more populist philosophy reigns at Native Instruments, a Berlin company founded in 1996 by a couple of German synth-heads. Devoted to bringing slick and cool music software to the masses, NI has already released 10 or so products to great acclaim and is flush with investment capital and programmers. The company has released classic synth emulators and a dynamite DJ mixing program called Traktor, but its flagship product remains Reaktor, a modular synthesizer and sampler that provides Max-style powers in a more accessible package. Mate Galic, Native Instruments' audio evangelist, compares snapping together Reaktor's audio modules to playing with Legos.

NI also acts a bit like a record label, putting together CD compilations and sponsoring live events in Europe, where electronic music is both more mainstream and more integrated into the art world than it is in the US. Even the company's software releases radiate a cool, edgy vibe. As Galic puts it, "We see software as an artistic creation, not just a tool." Some NI software comes complete with its own aesthetic style: Spektral Delay, released last year, transforms practically anything you throw at it into a warm and spacey track reminiscent of the Berlin dub artist Pole. Conversely, one NI music compilation has its own software: Mewark-Stoderaft, created by the Russian hacker-composer Lazyfish, is a Reaktor-based interactive audio track designed to be manipulated directly by the listener. "Eventually, software instruments will become pieces of abstract electronic music," says Galic. "You will just let them run, and they'll never stop."

THE COMING OF autonomous, self-generated music has long been prophesied by the ambient graybeard Brian Eno. Today, that's a sure thing; it's also a problem. Software instruments never stop changing, never stop offering up more of those infinite possibilities we're always hearing about. Compare the situation with, say, playing an acoustic guitar. Years of practice are necessary before you really begin to discover the hidden potential inside that rounded box with six metal strings and a hole. But right off the bat, software instruments – especially modular ones like Max/MSP and Reaktor – provide a dizzying number of powerful effects. This makes it easy to endlessly tweak your material rather than to accept the constraints that partly define the act of composi-

NO ONE BALKS AT SAMPLED VOICES ANYMORE. THESE DAYS, MILLI VANILLI SEEM LIKE PROPHETS, NOT CHEATS.

DAN THE AUTOMATOR **(Gorillaz)**



The more powerful the machines are, the less they obstruct your way or dictate what you have to do. Most of the synthesizers I use are basically sampled or sound-generated, so they are all computer based. A lot of the effects are old stuff, but all the recording and sound generating is done on Macintosh computers.

The most important piece of equipment I own is probably my mobile phone. I'm all over the country all the time, so that's what I use to take care of business, set things up. Other than that, the most important item is Pro Tools. Basically all the music I do is recorded on Pro Tools. Every musician has to have it. It's the one constant. But I don't think it lives up to the hype; they do these horrible upgrades, and everyone I know just hates it.

But Pro Tools is so firmly entrenched at this point, it's hard to use anything else. It's a monopoly.

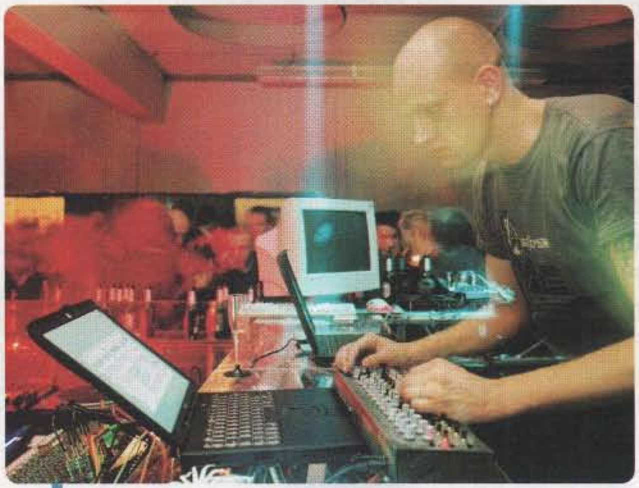
tion. And this is particularly true when you can tinker not only with the sound but with the virtual machine that makes the sound.

For Robert Henke, a 33-year-old member of the Berlin-based ambient dub group Monolake, it boils down to this: "Do I go to the studio and make a song? Or do I make a new tool to make another song tomorrow?"

Henke decided to do both, and the strategy paid off. In 1999, he and then fellow Monolaker Gerhard Behles helped found Ableton, a software company that recently released Live, a much-praised audio sequencer. Live brings to real-time performances the kinds of sculptural control over loops and samples that one has in a studio environment. "There are two approaches you can take with your music software," says Behles, who quit Monolake in order to run Ableton full-time. "One is to consider your tools as fixed. The other is to control the tools themselves. That gives you a much bigger lever. But it can keep you from ever doing music again."

A lot of what passes for experimentalism in popular electronic music represents an obsession with the big lever – whether it's Reason, Max/MSP, Reaktor, Live, or something even newer. The desire to constantly reprocess material, and to release the results as finished products, is only amplified by the constant turnover of software. "There's a new piece of software every day," says Oakland, California's Miguel Depedro, who runs the Tigerbeat6 label and records whacked-out sampladelic electronica under the name Kid606. "By the time you've learned how to use something, there's already something else. I would love for everything to just pause right now – no new advances, no faster computers, no new Max. And then we'll see what we do for the next two years."

Depedro's reaction to the infinity of options is to largely ignore them. Instead of geeking out over new software, he goes punk rock, injecting bratty-ass fun into a music dominated by tech talk of fast Fourier transforms. His live shows unleash dense hip hop and R&B from the twin-barreled plunderphonic bazooka fashioned from two PowerBooks and a multichannel DJ mixer. And a recent Kid606 bootleg EP, *freakbitchlickfly*, features Depedro mangling unauthorized snippets of Missy Elliott's "Get Ur Freak On" into a Ritalin stomp. The turn away from process-heavy hermeticism represents a rejection of the technological futurism of the '90s, which mindlessly embraced the latest upgrade as the avenue toward fulfillment and success. As Depedro



Monolake's Robert Henke performs an ambient set.

Joshua "Kit" Clayton prepares for a gig.

Twerk, aka Shawn Hatfield, onstage.

PHOTOGRAPHS FROM TOP: ALEXANDER KURZ; JOHN MENDEZ; ALEXANDER KURZ

points out, "You don't even need a computer to play live electronic music."

Even a few programmer-musicians echo some of Depedro's concerns. Joshua Clayton programs for Cycling '74 and remains captivated by the nitty-gritty processing available in environments like Max/MSP. Clayton also has concerns about the aesthetic attitude that such programs can produce. "I find that people who use Max and similar programs often aspire to be the god behind the universe, to come up with formal system that's completely under their control. Some people can't wait to get everything inside the computer so they can generate some kind of utopian music that's all contained within the machine." For Clayton, who still loves to sample the analog world with a hand microphone, music that just plays itself is anathema. "We are at a confusing point in time," he says. "These mechanical processes are the only things the culture can latch onto, but at the same time there's something unpleasant about them, something a little weird."

THE PARTY IS Joypad, the place is San Francisco, and local laptop wizard Twerk is playing one of the most engaging live ambient sets I've ever heard. Oddly processed sounds build up shimmering textures as feedback loops envelop one another and beats slowly unfold like a flower bud in a time-lapse film. Along with working his PowerBook, Twerk twirls a set of knobs on a small controller. Next to me, a punkish brunette explains to her friend that the knobs are controlling various parameter values for the algorithms that make up Twerk's live patch.

This is clearly not rock 'n' roll.

Neither is Twerk's home studio, which takes up the living room of his apartment in San Francisco's Western Addition. The space is frighteningly neat, the dust-free computer desk bare except for a handful of CDs stacked in a crisp brick.

Twerk, aka Shawn Hatfield, is recognized as one of the leading programmer-musicians on California's laptop-techno scene, but the 28-year-old native didn't even own a computer a few years ago. Originally a hip hop DJ – "spray cans were our technology" – Hatfield began making straight-ahead techno records in the late '90s. On a whim, he bought a copy of Cool Edit Pro and started playing with it on his girlfriend's Sony Vaio. He was hooked. He plunged into Reaktor and then upgraded to Max/MSP, and his techno records began to mutate. "My music started to get more experimental because the tools themselves are experimental." Eventually he sold all his analog gear. "I'm not even trying to emulate analog. I'm trying to make new sounds, computer sounds."

All musicians who use computers must come to terms with the peculiar situations created by software. Some, like Depedro, turn toward showmanship, while others, like Clayton, balance digital control with analog sounds and sensibilities. Hatfield, however, represents another way: into the machine. His latest record is called *Now I'm Rendered Useless*, which runs techno conventions through a giddy but decidedly alien beat percolator. The title refers, in part, to Hatfield's feelings after being dumped by his girlfriend, who got sick of his geekish ways. It also refers to his increasing reliance on virtual music machines that, in a sense, do his work for him. "Building these sequences in Max, I could tell the machine to do everything that I do. It was like building human replicators to copy the way I would make music."

To keep his sounds from growing predictable, Hatfield introduces randomly fluctuating values into his patches. "I'm never able to get the sounds that I hear in my head," he explains. "So I just play with randomness and let these things happen naturally. The networks of sound generation I set up are just spewing out all of this chaos, and from that I pull out the pieces that are worthy. It's like a garden that you're constantly trimming and manicuring."

Like many electronic musicians, Hatfield divides his time between building patches and making tunes with those patches. After amassing a library of them, he decided to release one – which he dubbed drool_string-ukulele – to the online community of music phreaks. "At first I was afraid of giving away my style," he says, noting that, unlike Reaktor fans, a lot of Max-heads are rather cagey about their work. "But when I started to get back all these crazy random tracks, I was very inspired. They were so different than I expected. Now I get off stoking people out with cool shit."

For Hatfield, building virtual machines is at least as engaging as making tunes. He's learning C++ and contemplating a potential career as a music software developer. His girlfriend has come back, yet he continues to embrace technology. "Computers have given me an amazing amount of fulfillment and joy," he says. "If I don't have a computer, I almost feel like I'm only half of who I am. I think at some point, when technology is ready, I will become the machine that I'm using." ■ ■ ■

YOU CAN MAKE A SONG TODAY, OR MAKE A NEW TOOL TO MAKE A SONG TOMORROW. BUT THAT CAN KEEP YOU FROM EVER DOING MUSIC AGAIN.

MATTHEW HERBERT

PHOTOGRAPH: COURTESY MATTHEW HERBERT

I work with samplers of various types, and the challenge is to fill them with interesting things. The best one is the S612 by Akai; I have 10 of them. It was the first one they ever did, and it's quite Fisher-Price. There's an amazing new sampler by Roland called the VP-9000, which is designed to slow things down and speed things up in real time – it defies the laws of sound.

The new stuff I'm working on is about the sounds of corporations – like McDonald's and Disney and the Gap – that I hate, using their products to generate noise and then destroying them. On a track called "Starbucks," every sound you hear is made entirely from a Frappucino and a caramel latte, of me pouring it down the sink and doing everything except drinking it.

Entering music into a computer with a mouse is a completely inhuman experience, and I think we'll look back in 50 years and laugh at how people were supposed to put their ideas across using one button and a 17th-century keyboard.

Would You Download Music From This Man?

EVERYONE ELSE DOES. MEET THE ONE-STOP SHOP FOR EVERYTHING FROM MP3S TO *A BEAUTIFUL MIND* AND EVERY GAME BOY TITLE ON THE MARKET.

BY JEFFREY M. O'BRIEN

PHOTOGRAPH BY MICHELE ASSELIN

DAN VERNER pipes music into his bathroom. Same for his living room, kitchen, and every last corner of his home. He wired his place with a 28-speaker stereo system that cycles through 3,000 songs, ranging from 200 Elvis Presley tunes and all the early Beatles to classical, hip hop, blues, and concert bootlegs – even Axl Rose doing "White Christmas." "I have enough music to run a radio station," he says. "I could let it play for a week and it wouldn't run out."

Not long ago, compiling a Sam Goody-style assortment of popular and hard-to-find music would have taken a lot of money and some great connections. But Verner hasn't spent a dime, and his only real connection comes in the form of a cable modem. Lord of the Borrowers, as he's known in the peer-to-peer file-sharing world, is just a regular guy with a knack for collecting free stuff.

It's been almost a year since a federal court sided with the Recording Industry Association of America and forced Napster to shutter its network. The thinking was clear: Stop the technological enabler, and the illegal transfer of copyrighted songs should grind to a halt. But that hasn't happened. Thanks to the many services that have risen up since Napster's demise – Audiogalaxy, BearShare, iMesh, KaZaA, LimeWire – sharing has continued. Millions of users are still swapping billions of files. What's different is the quality and breadth of what's now changing hands.

Today, anyone can find big-budget films, music videos, high-end software, vintage porn, and of course, a whole lotta audio.

Lord of the Borrowers logs on with a client called Morpheus, which allows him to swap files not only with Morpheus users but also with anyone on BearShare, LimeWire, or any other part of the Gnutella network. And more sharers are signing up all the time. Morpheus has been dragged from Download.com more than 71 million times in the past year.

Verner spends several hours every day seeking out new files to add to his 54-gigabyte collection. For a while, music was his passion, but he's moved on. Long before most people had even read a review of *The Lord of the Rings*, he had held a screening of the epic in his home. Same for *Harry Potter*, *A Beautiful Mind*, and *Black Hawk Down*. He has accumulated nearly 2,500 movie, video, and software titles. "I have every Game Boy game on the market," says the 44-year-old part-time computer consultant. "All the animators, all the Photoshop programs, and Microsoft Draw."

A decade ago, Verner was just another pop-music fan who knew nothing about computers. That changed after he got knocked off a ladder by a 600-volt electrical current. In that moment, he had a heart attack and dropped to the floor – a fall that crushed the vertebrae in his neck and put an end to his career as an electrician. "Before that, I was a workaholic," he remembers. "All of a sudden I found myself at home, staring at four walls." He bought a PC and began tinkering. Even while taking 1,800 milligrams of morphine a day to fight the pain, he taught himself how to repair computer systems. Then he discovered P2P.

To anyone who can't afford to take the family to the movies or buy the latest PlayStation 2 title, Verner has become that lady at the end of the block who gives away full-size Snickers bars on Halloween – except he's handing out thousands of files. "Users look for people like me," he admits. The moment Verner logs on, visitors begin poring over his collection. He saves bandwidth by limiting outbound files to eight at a time, but is otherwise wholly accommodating. He rotates through hard drives to maintain a fresh offering of roughly 1,900 titles, and constantly monitors user activity. "If someone gets greedy, I'll shoot them a note and say, 'Give someone else a chance.'"

Snoedog, a fellow Morpheus user, has been feasting on Verner's collection for four years. "If there's something I have to have, I'll check with him first," she says. "He's got everything."

Which raises a question. What motivates someone to collect more music than he could ever possibly listen to, more movies than he can watch, more games than he could ever play – and so actively spread the wealth? It's no stretch to say Verner's responsible for millions of dollars in lost revenue for the record labels and movie studios. And while he considers those industries "damn greedy," it's not malice that drives him. "A lot of people out there don't have any idea what their computer really is for and how much they can enjoy it," he says. "I think I'm doing a public service."

He's not alone. Take the Orange County, California, homemaker who goes by the handle Canary. Dialing in on a modem, she has collected 3,000 files and leaves her line open at all times so that others can have at her collection. To her, it's about being neighborly. "If we borrow our neighbor's tools," she says, "are we robbing the tool manufacturer of the revenue they deserve?"

Jack, a Detroit DJ, has downloaded more than 12,000 files mainly from FTP servers run by other DJs looking to spread the word about the fast-moving dance-music scene. "I download 100 songs and listen to each for 30 seconds to see what I like," he says. "I do still buy records – just not as many as I would."

Obsessive? Definitely. But as the battle over file sharing intensifies in the world's courtrooms, users like Verner, Canary, and Jack are providing the content that keeps the P2P community alive. According to a study performed by Xerox PARC researchers, the top 20 percent of Gnutella users are responsible for 98 percent of all files shared. These supersharers prime the network for an influx of users, which in turn creates a plump market for technology providers and advertisers. Thanks to them, file sharing has even improved in some ways since Napster's passing. Now, when you crash mid-download, Morpheus will pick up where it left off.

With broadband connections more common, it's also easier to find and download high-quality files. But viruses are more prevalent, too, as are pop-up ads and porn. This bothers the Lord of the Borrowers because his son has recently taken to file sharing. But not to worry. "I'm running a program on his machine that I got off of Morpheus," says Verner. "It records everything he types."

Modern problems, after all, require modern solutions. ■ ■ ■

Senior editor Jeffrey M. O'Brien (jeffo@wiredmag.com) *wrote about kitesurfing in* Wired *10.04.*

OBSESSIVE? DEFINITELY. THE TOP 20 PERCENT OF GNUTELLA USERS ARE RESPONSIBLE FOR 98 PERCENT OF ALL FILES SHARED.

MALCOLM McLAREN

I think at one time, people used to shop for music. Now people shop to music. Music is a secondary medium, and fashion has taken over. Music puts one word – entertainment – into shopping. We use music to look at things, to watch, to style – for every activity other than for its own sake.

I started to make music as a film director would make a movie – but without a camera. I was left with sound, and out of the sound, I have to tell the story. I remember what James Brown said about me: "Musicians are usually looking at their guitars, but this guy is always looking out the window." Because I'm forever trying to paint the picture. But I'm trying to do that by music. So that's how I work.

I think more and more, music will be made by people who aren't musicians. In some instances, that's creating music that might be considered far too karaoke. But it may spark a very different kind of music, one that's not governed by structures that were originally created by musicians.

PHOTOGRAPH: RETNA

WIRED MUSIC

Six Machines THAT CHANGED THE Music World

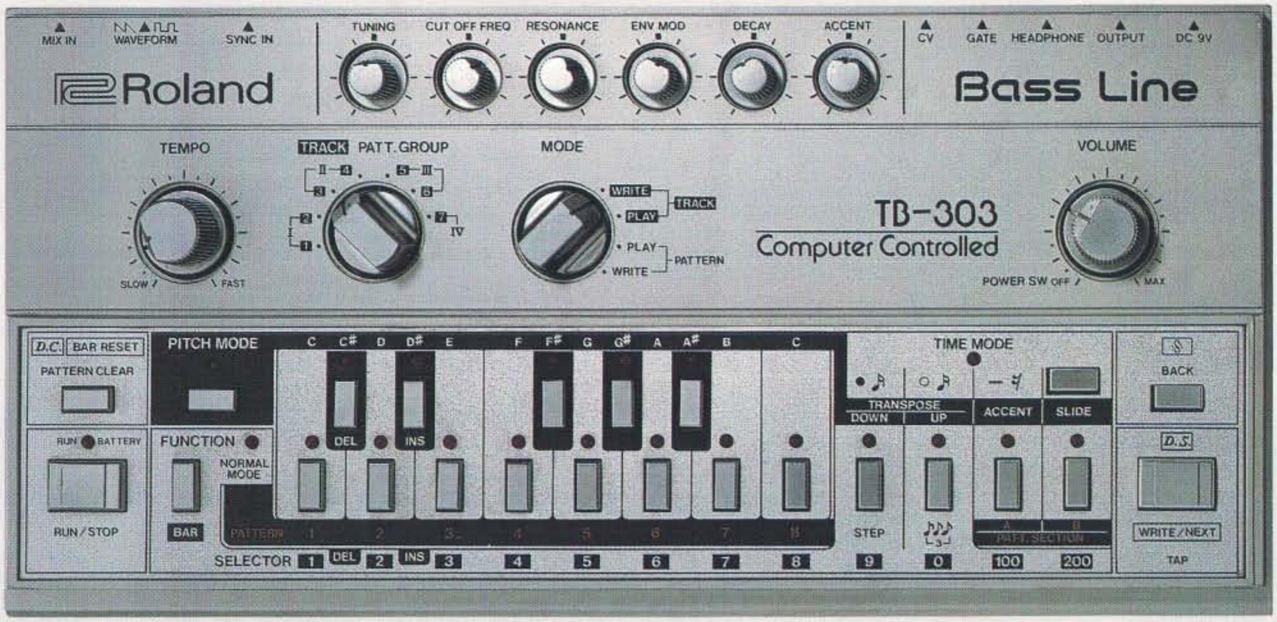
BY PAT BLASHILL

PHOTOGRAPHS BY MIKE LORRIG

EVER SINCE SAM PHILLIPS stuffed some wads of paper into an amplifier, inadvertently creating the fuzzed-up, overdriven electric guitar sound on Ike Turner's 1951 rave-up "Rocket 88," pop musicians and producers have turned happy accidents into great records. But the history of house and techno, in particular, is underpinned with fits of serendipity and creative perversions of recording technology.

In the early '80s, Detroit techno pioneers like Juan Atkins and Derrick May – inspired in part by club DJs who'd begun using turntables as instruments, and limited by a profound lack of expendable dough – began picking up secondhand analog drum machines and keyboards that had been dumped by musicians who thought the equipment sounded too mechanical. Atkins & Co. were able to create techno music with these seemingly clunky tools precisely because they didn't *want* machines that sounded like human drummers. "For some, I guess, 'synthesize' means 'duplicate,'" Atkins says. "But for me, 'synthesize' is synonymous with 'create.'" The gear that Atkins and others used is the pulse of modern electronic dance music. The Roland TB-303 Bass Line is a bit like the Forrest Gump of all things electronica, its muddy squelch having been present, like a comedic cameo, in the mix of nearly every key mutation of house, techno, big beat, and jungle. What follows is a history of the 303, the 808, and a few other marvelous dumb-bots, as well as a look at the accidents and ecstatic noise that have emerged from the crossfire between technology and harebrained human creativity.

STYLIST: ANDREA KRAUN



The Mutant

ROLAND TB-303 SYNTHESIZER

IN 1982, the Japanese corporation Roland introduced the TB-303 Bass Line. Company engineers designed the synthesizer to be used by musicians for recording demos, or rough sketches of songs, which could be played for music-industry executives, then later redone with "real" instruments – presumably after the songwriter had landed a lucrative contract. Roland also envisioned the box as a rehearsal device for electric guitarists who found themselves without flesh-and-blood bassists. The 303, however, sounded nothing like an actual bass guitar. American musicians, disappointed with its two-dimensional, mechanical sound, began selling their slightly used 303s to pawnshops, and by 1985 Roland ceased production.

But the TB-303 was reborn as a much stranger beast that year: Earl "Spanky" Smith picked up a 303 in a Chicago secondhand music store and took it back to his place, where his musical partner, Nathaniel Jones, tinkered with the box. Jones, who was beginning to DJ under the name Pierre, played with a row of knobs – Resonance, Decay, and Cut Off Freq – for adjusting the bassline; the controls were meant to be set, then left alone during recording or rehearsal. But Pierre programmed a bassline, hit the Run button, then cranked each of the knobs to its upper limit as the bassline was playing back. The 303 reacted with a piercing, almost obscene screech.

"Spanky was saying, 'Keep doing it, keep doing it!'" Pierre remembers. "It wasn't meant to squeak and squeal and all that kinda stuff. We just knew it sounded weird and energetic and funky. We thought, 'Wow, this thing is really a jolt of lightning!' So we taped it and took the tape to [legendary DJ] Ron Hardy's place, the Music Box. We played it, and by the third time people were going crazy."

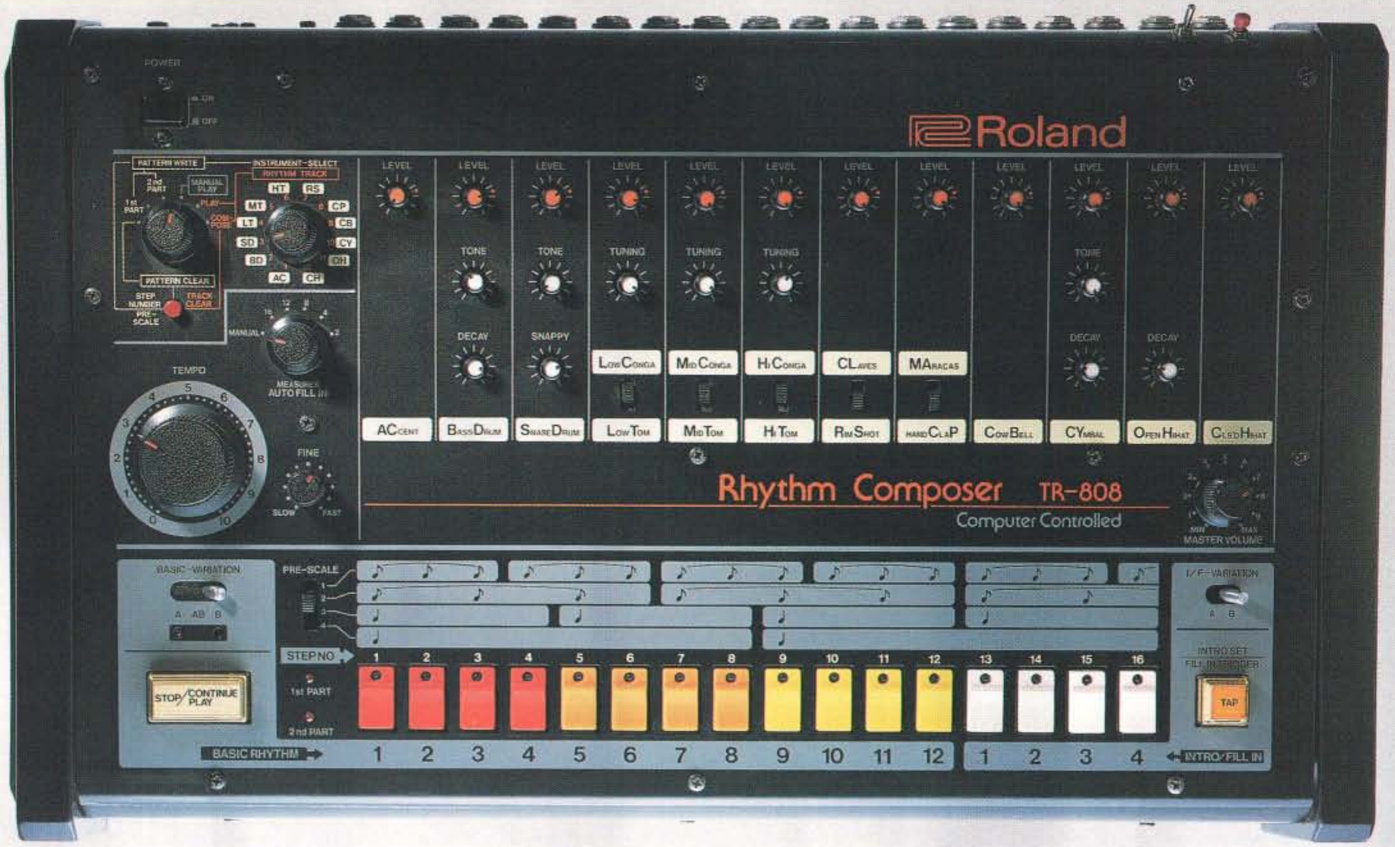
Though they didn't know it at the time, by adding the warped, druggy 303 sound to then-standard club beats, Pierre and Spanky had invented a new genre of dance music: acid house. They dubbed themselves Phuture, then released their 303 experiment as "Acid Trax." That record, as well as other tunes like Sleezy D's "I've Lost Control" and Adonis' "The Poke," were club hits in Chicago; once imported to England, they became salvos in a massive youth cultural movement that begot electronic subgenre after subgenre. "One of my friends used to live on a mushroom farm," says the Chemical Brothers' Tom Rowlands, "and he had this shed at the back of his garden. We used to sit in there playing a 303 – that was my idea of a perfect afternoon." The box, which can be made to emit everything from wet squeals to bird chirps and peeps, reached the top of the American Billboard charts in 1997 via Prodigy's *The Fat of the Land*.

But the TB-303's acid sound had already achieved immortality. The year before, Roland moved to capitalize on the machine's popularity with techno producers by introducing the MC-303 Groovebox, a synthesizer that could simulate the mutant TB-303 Bass Line as well as beats from the TB-909 and TR-808 drum machines. Pierre remains philosophical about his discovery of the sound that launched a thousand 12-inch records.

"When you make music, you just never know what the heck is going to happen. Some mistakes are good – it's just a matter of knowing which ones are good and which aren't."

Pat Blashill (pblash@rcn.com) *wrote about AI maestro Gerhard Widmer in* Wired *9.09.*

COURTESY ANALOGKEYS@AOL.COM



The Stepchild

ROLAND TR-808 DRUM MACHINE

AFTER PIONEERING the manufacture of drum machines, Roland began to lose its competitive edge in the early '80s, particularly when rival Linn introduced the LinnDrum, which featured beats derived from digitally sampled drums. For musicians in pursuit of an authentic sound, the LinnDrum overshadowed analog synthesizers like Roland's TR-808, which seemed mechanical by comparison. But the 808, introduced in 1979 as a tool for high-end professional musicians to record demos (original list price: $1,195), was slowly finding favor with producers of the then-nascent form of music now called hip hop. In 1982, a black Trekker from the South Bronx named Afrika Bambaataa and the downtown producer Arthur Baker used an 808 to record the intergalactically funky "Planet Rock," perhaps the single most influential track in the history of hip hop, techno, and electro music.

But Roland wasn't listening. It had already ceased production of the machine, even as Chicago DJs like Jesse Saunders picked up 808s secondhand and began using the box in an ingenious way: They "played" it live, like an electric guitar or any other old-fashioned instrument. Saunders employed the 808 as the unifying thump of his marathon 6- to 12-hour sets at the Playground club (which typically included "Planet Rock" and tunes by the B-52's). This was the dawn of house music, yet the TR-808 would play an even more crucial role in techno, especially after trailblazers like Juan Atkins embraced the little black box. Years later, electronic innovators were still name-checking the device. In 1988, a British group that helped define ambient techno named itself 808 State; in 1997, breakbeat scientist Optical redefined dark drum and bass with his sinister, sternum-rattling "Moving 808's" single. But many techno musicians were, and still are, drawn to the internal imperfections of the 808, to everything it wasn't, instead of everything Roland had wanted it to be.

"The 808 and the TR-909 [another key drum machine] both had what I'd call a certain 'slip' to them," explains second-wave Detroit techno pacesetter Richie Hawtin, also known as Plastikman. "They didn't lock at a certain exact tempo. Even when the tempo meter read 130 beats a minute, it only said that because there were just three digits in the counter. That timing slip gives those 808s a certain groove. You can actually open up an 808 and there's some extra knobs inside, so you can detune the box. You'll get lower tones, slightly snappier snares. These little knobs were manually set at the factory, so every 808 is completely different. My track, 'Spastik,' is basically just an 808. It's the most well-balanced track I've produced yet. And it's annihilated everybody who's ever heard it."

The Workhorse TECHNICS SL-1200 TURNTABLE

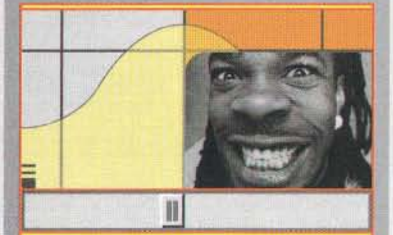
"THE TECHNICS 1200 is the *only* turntable," says Moby. "That's where all the samples come from." Techno music's man of the hour is merely stating the worst-kept secret in electronic music. Since its introduction to the home stereo market almost 30 years ago, the Technics SL-1200 has been the tool of choice for professional DJs as well as sampling musicians. The deck has endured because it's built like a tank: Made of steel and diecast aluminum, it weighs in at 27 pounds, and has incredible rotational stability and a very long service life.

Technics began selling the SL-1200 in 1973, and New York-based proto-hip hop DJs like Grand Wizard Theodore and Afrika Bambaataa almost immediately began to creatively misuse the decks. They invented scratching when they found that the motor would continue to spin at the correct rpm even if the DJ wiggled the record back and forth on the platter.

But turntablists and beatheads are still finding new ways to hack the SL-1200. Influenced by the hyperspeed mixing techniques of techno DJs like Jeff Mills, Detroit ghetto tech DJs like Disco D (real name Dave Shayman) sling together short blasts of Miami bass, drum and bass, and "booty" records with surreally filthy lyrics, playing every track at impossibly fast speeds. Disco D routinely opens up the turntable, adjusts a little-known small blue knob in the rear right corner of the deck, then reassembles the machine, which is then capable of spinning records up to 14 percent faster than they were meant to be played.

"Some people say you can never get a 1200 back to normal after you've adjusted it that way," explains Disco D. "Actually, I've run into problems with promoters who aren't so happy I've done that to their turntables. But I specify right there in my booking contract that that's what I do. If you want me to play, I'm gonna have to mess up the turntables."

BUSTA RHYMES



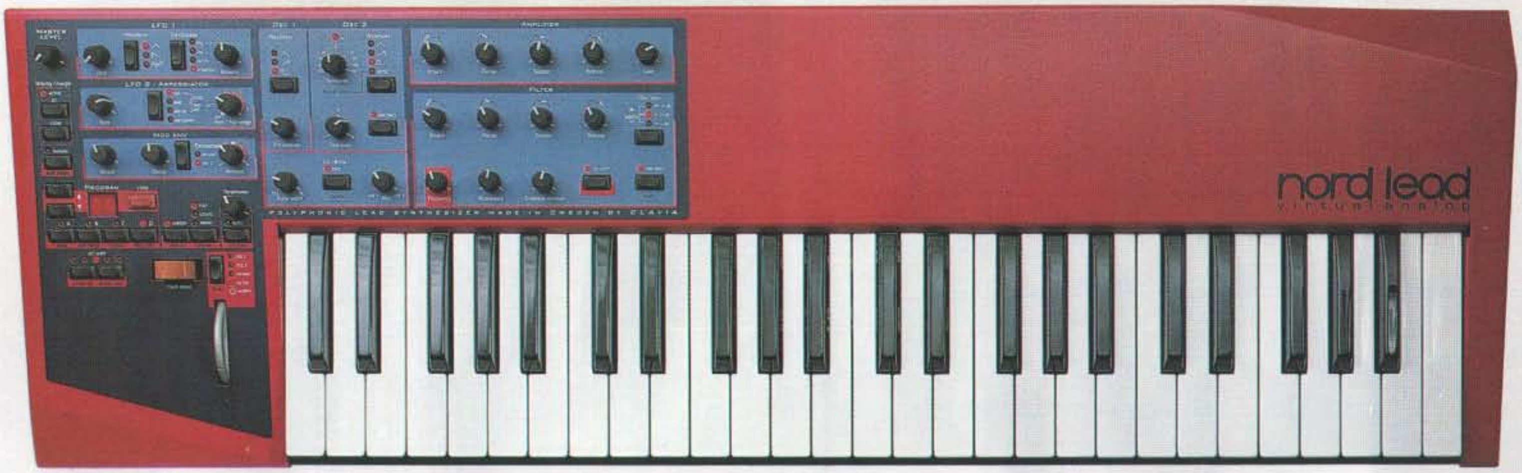
I'm not majorly technology-literate, but I'm literate in terms of what I work with to make music. I just use what we all use in hip hop: Akai MPC-3000 and E-MU SP1200 synthesizers, Akai S5000 sampler, and SSL mixing boards and Pro Tools. That's the basis of hip hop. We ain't fucking around with bands. Make a track, add an MC – it's convenient.

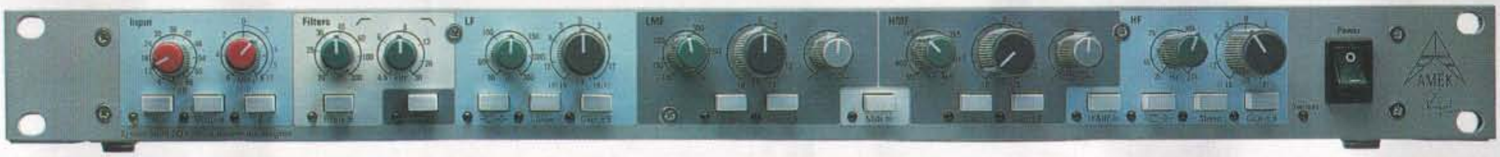
On our tour bus, normally I bring Tascam DA-88s, 8-track modules that you can combine and have as many tracks as you need. We also got Xboxes and PlayStation 2s, and when I get around to it, I love the martial-arts games.

I'm an analog dude, but I deal with digital because of the convenience and speed. Analog gives you a warmer sound, and you can get more of a *thump* out of your analog shit; digital cleans it up a little too much.

I have no idea where music is going creatively. As long as there's a mind to create a new idea, I'm sure technology will always introduce new shit for us to fuck with.

PHOTOGRAPH: RETNA





The Screamers

NORD LEAD 1 KEYBOARD, AMEK SYSTEM 9098 EQUALIZER

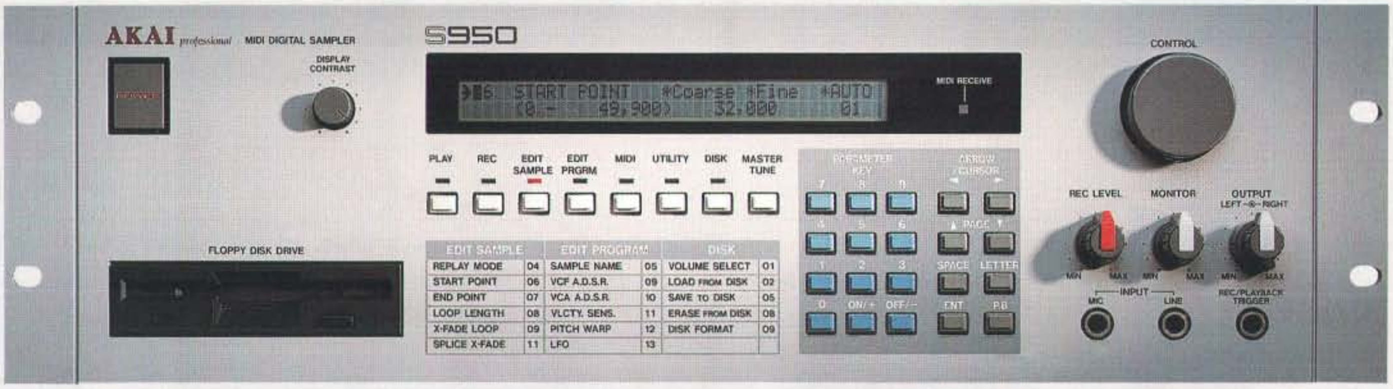
IN THE SACRED AI text *Gödel, Escher, Bach*, Douglas Hofstadter uses dialog between a tortoise and Achilles as a metaphorical device to explain mathematical concepts. In one of these, the tortoise invents a record that is unplayable because it is composed of sounds that will cause a turntable to vibrate and shake so violently that it shatters into a hundred pieces. Detroit techno legend Derrick May has never read *Gödel, Escher, Bach*, but in 1995, he one-upped the tortoise. He created a tune that was so dissonant it could not be made into a record.

In 1995, the Swedish company Clavia introduced the Nord Lead 1 keyboard, which used digital signal processors to emulate analog synthesis and give the instrument "the warmth and richness of the traditional analog sound." Ironically though, when May used the synth in combination with actual analog recording gear, he produced sounds that traditionally give recording engineers migraines.

May was making a song called "To Be or Not to Be" for the soundtrack of a PlayStation videogame called *Ghost in the Shell*. His setup included the Nord Lead 1 and an Amek System 9098 outboard equalization module, a device that producers typically use to attenuate, emphasize, or otherwise pump up selected frequencies in the audio spectrum. May went a little further: Intent on creating a whooshing effect known as phasing, he jacked up the amplitude of a few selected audio signals so high that they fell out of synchronization with the other sounds. The resulting tape could not be transformed into a master, the original recording that is necessary to manufacture a vinyl record.

"They couldn't do it because at one point the track was so out of phase, it would cause the mastering needle to burn out," May says. "And those needles cost $400 or $500 a pop. So I got a call from the guys at the plant in Belgium saying, 'Look, we gotta compress it, because you did so many crazy-ass things.'" Compression, a method of sound signal processing and readjustment, tamed the wilder tones of "To Be or Not to Be" so it could be included on *Innovator*, a compilation of May's work. But he insists that his original version is exponentially more mind-blowing.

"I actually prefer to master all my music onto a reel-to-reel tape deck," he says. "With today's technology, everybody's using some form of software to master records, which is limiting them – the program logic says, 'These sounds are wrong.' That means that no matter how radical you may be, if you don't record within the set boundaries, fuck it, you can't do it. So there's this invisible law in technology that's policing our music."



The Transformer AKAI S950 SAMPLER

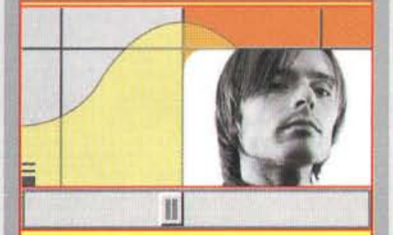
SAMPLING TECHNOLOGY has been as essential to electronic music as Stratocaster guitars have been to rock 'n' roll, but one machine, the Akai S950, has played a particularly crucial role. German producer Atom Heart used an S950 when he recorded "Cosmic Love" – the blueprint for trance music – with techno duo Resistance D in 1992. In 1993, a new Akai S950 lit up the life of Josh Davis, a kid from California, who would soon be known as DJ Shadow. He used the console to perfect a method of blending one sample into the next, instead of neatly placing them side-by-side, which leaves a split second of digital blank space in the mix – but one that's audible to the trained ear. Shadow's approach, later displayed in the track "Midnight in a Perfect World," from his groundbreaking *Endtroducing* ..., gave his downbeat aural collages an organic feel and kick-started the electronic subgenre thereafter known as trip hop.

But the S950 was also the infernal device responsible for a happy accident during the 1995 recording of a lesser-known, slightly sinister tune called "Don't Laugh" by the Philadelphia DJ Josh Wink. It happened after Wink pulled a long weekend of late-night club sets and went into his studio to start recording.

"I'd had three hours of sleep in three days and been traveling, and I was so head-screwed that the only thing I really felt like doing was laughing," Wink explains. "So I sampled myself laughing, then put a simple Roland 303 line over that, and then added a 909 kick-drum sound, open high hat, and a clap. That's basically the track. The accident in the track happened when the sample started changing in pitch. By mistake, I'd hit the value transpose knob on the 950, and all of a sudden the sample got pitched down an octave. I thought, 'Wow, this is cool.' There was just so much tension in there that it made the song pretty eerie. And after the record came out, people started coming up to me and saying, 'Dude, I had the worst trip of my life because of you.'"

Wink, who says he doesn't do drugs, later went on to spur a Roland TB-303 revival with "Higher State of Consciousness," a hymn to the disruptive, earsplitting power of that box. But after "Don't Laugh," he developed a theory about studio mishaps: "Sometimes the best things come about from mistakes. Usually, the 'Oops!' become the 'Ahhhs!'" ■ ■ ■

JEAN-BENOIT DUNCKEL (Air)

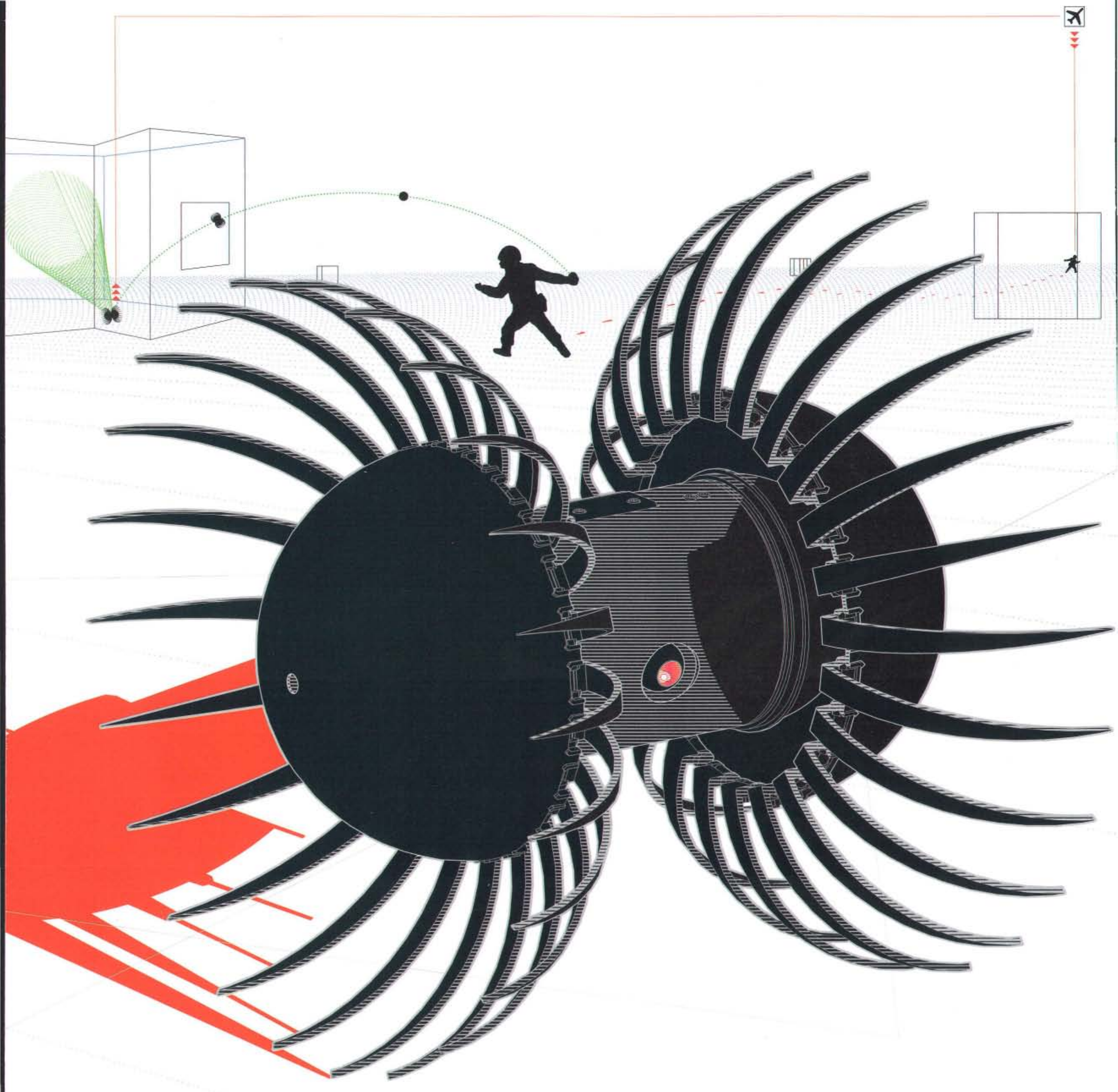


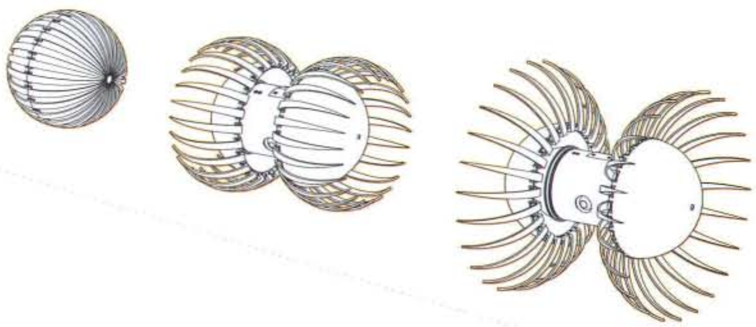
There is a sensual relationship between the machine and human beings. In the studio you have to plug and de-plug these machines all together. It's very sexual. It's like trying to organize some lovemaking parties between the machines, and some machines are not able to fuck with others. We have the feeling to make love to them, too.

We only buy electronic equipment with red LEDs. I don't know why, but the reality is that all the good things have got some red lights on them. With the Korg ER-1 Electribe beat box, it's so easy to do something modern. You just turn the knobs and it sounds good – and the buttons are red, so it's beautiful in the dark.

I've got a little Sony DAT recording unit; I know it's like a cliché, but in a hotel room I recorded the noise of my toilet because it was producing a sort of rhythm with water. I also like these famous orange speaking toys from the '70s, Speak & Spell! The tune of the voice – the timbre – is amazing. I've got two.

PHOTOGRAPH: RETNA





Draper's Spike – an early throwable bot – paved the way for smaller and smarter roving reconnaissance machines.

THE NEW MOBILE INFANTRY

Battle-ready robots are rolling out of the research lab and into harm's way.

By Michael Behar

Illustrations by Martin Woodtli

Lieutenant Colonel John Blitch retired from the Army last fall, filling out the paperwork in an out-processing office of the Pentagon on the morning of September 10, 2001. In his three years at the helm of the Defense Department's Tactical Mobile Robots Program, Blitch had funded nearly a dozen academic and corporate research efforts. Their goal: building bots to replace human soldiers and rescue workers in dangerous situations. Barrel-chested and brawny, the 43-year-old Special Forces officer was leaving to direct the Center for Intelligent Robotics and Unmanned Systems at the Science Applications International Corporation, an engineering outfit and defense contractor in Littleton, Colorado. He planned to start the 1,500-mile drive the following day.

With news of the terrorist attacks, though, Blitch scrapped the trip. He removed his belongings from the flatbed trailer hitched to his pickup, loaded up a set of tactical mobile robots, or TMRs – most about the size of a football and fitted with rugged treads and an assortment of sensors – and headed for New York. On the road, Blitch donned his fatigues, dug out his military ID, and worked his cell phone, summoning colleagues from Florida to Boston to pack up their finest tactical robots and rendezvous at Ground Zero. "When I arrived, we passed through 32 checkpoints," he recalls. "People were asking, 'Who is this guy in camouflage running around with grad students and robots?'"

Over the next 11 days, the group's 17 robots squeezed into spaces too narrow for humans, dug through heaps of scalding rubble, and found seven bodies trapped beneath the mountains of twisted steel and shattered concrete. While that was only a tiny portion of the 252 victims recovered by rescue workers, the success triggered a deluge of fawning press ("AGILE IN A CRISIS, ROBOTS SHOW THEIR METTLE," announced *The New York Times*. "ROBOTS HELP WHERE HUMANS FEAR TO TREAD," echoed the *Houston Chronicle*). The publicity helped Blitch avoid a berating from his superiors for skirting regulations and passing off specious credentials (technically, he was retired).

More important, the mission proved the viability of Blitch's grand ambition: "to build robots that can do things human soldiers can't do, or don't want to do." Although the machines at Ground Zero were used for search-and-rescue, the real-world test reinvigorated researchers developing more versatile soldier robots to handle reconnaissance, live combat, and all-purpose warfare.

While robotic research has been trudging forward for nearly a half century, TMRs are a fairly recent innovation. Darpa launched its program in 1997 under the leadership of Eric Krotkov, a former Carnegie-Mellon roboticist and an expert in planetary rovers. Krotkov signed up the first 10 contractors for an initial five-year, $50 million initiative. Blitch took over one year later, funding 25 major projects and more than a dozen smaller ones – all told, they produced 43 prototypes and 18 unique robots.

Today, more than 40 Darpa-backed companies and academic labs are developing robots. There are recon machines that can be air-dropped into enemy territory and relay back intelligence data in real time. There are 3-pound surveillance bots that frontline soldiers could lob through a window or around a corner to get an audio and video preview of conditions. There are robots that can negotiate harsh terrain, scurry up stairs, or rush into battle to rescue injured soldiers pinned down by heavy shelling or gunfire. Other machines in development can carry weapons, deliver jolts of electricity, sniff for biogerms, and see through walls. There's even a walking robot, which could lead soldiers around blind corners, drawing fire from potential snipers. "We needed one of those in Somalia," says Blitch as he watches a demo video of the biped bot that's been spliced with gory scenes from *Saving Private Ryan*.

War is dangerous and bloody, and no robot can fundamentally change that. But the generation of tactical mobile robots now in development promises to help soldiers and save lives by taking on the tasks that Michael Toscano, coordinator for the Joint Robotics Program at the Pentagon, sums up as "dirty, dangerous, and dull."

From the outside, the SAIC Center for Intelligent Robotics and Unmanned Systems hardly looks like the home of a highly advanced platoon of military machines. The lab butts up against Colorado's Front Range on the outskirts of Littleton, about 15 miles southwest of Denver. It's one of several offices in a rectangular brick structure that could easily be mistaken for a vacant strip mall. The place is eerily silent. A tumbleweed is lodged under a rusty truck in the parking lot. A wild hare darts through the blond grass. The windows are tinted, blinds shuttered.

"We picked the building because the bad guys would never suspect we are doing such sensitive work inside," explains Blitch, who's standing in his office. He's wearing a neatly pressed white oxford shirt tucked into faded black Levis.

His hair, which has receded a bit, is close-cropped and spiky in front. Blitch bolts down the hallway and through a steel door into a 3,000-square-foot high bay stocked with electronics and metallurgy equipment. There are at least a half dozen robots positioned around the room with technicians tending to each.

Jim Hamilton, a software engineer, demonstrates the lab's prize work in progress, a prototype TMR that's part of SAIC's Raptor (short for robotic autonomous perception technology for off road) project. Raptor can function as part of a marsupial system, a concept he's been developing since 1995. "We wanted to penetrate a bunker, but the robot, called Goldie, was too large to fit inside," says Blitch. "So we placed a smaller tethered robot on top of her, and when Goldie got close enough we drove the second one off and into the bunker." The Raptor project, launched in 2001 with Darpa funding, will eventually include a small team of marsupial robots with a Raptor vehicle acting as the mothership. Troops will be able to air-drop Raptor into enemy territory, where it will release a team of smaller, roaming "munitions bots," or M-bots. These roamers will relay data back to the mother bot, which aggregates the information and transmits it wirelessly. The first ground-to-ground-to-air marsupial system, Raptor will give the military a way to scout behind enemy lines and gather strategic information, an assignment often carried out by a squad of paratroopers outfitted with night vision equipment, walkie-talkies, and M16s.

That's the hope. But the only territory the Raptor prototype searches these days is the SAIC parking lot. The prototype is built atop a commercial all-terrain vehicle, though if the robot is approved for military production it will be upgraded for battle with a low-profile, heavily armored exterior. Hamilton turns on the gas-powered Raptor with what looks like a car key (the next version will have an automated startup), programs a route via laptop, and uploads it wirelessly to the TMR. The machine gracefully motors around the parking lot, following Hamilton's choreographed movements. For manual steering, he employs an off-the-shelf Logitech joystick. Eventually, Blitch wants to create a digital glove that would allow soldiers to execute commands using American Sign Language: "You want to be able to hold your weapon in one hand and control the robot with the other," explains Blitch. Images and sounds from as many as 30 onboard sensors – including infrared, night vision, digital cameras, directional microphones, GPS, and laser radar for making detailed 3-D maps of almost any terrain – will transmit data over a wireless LAN to a display in the soldier's helmet. At the same time, M-bots will send their findings back to a Raptor vehicle so the incoming information can be assembled into a detailed real-time rendering of the targeted area and uploaded to a satellite.

Tactical robot efforts at other R&D centers are no less impressive. Since 2000, scientists at Draper Laboratory, in Cambridge, Massachusetts, have been working on a series of throwable robots – small, lightweight rovers that can be tossed into hostile settings. "Let's say I'm trying to see who's inside a building before I enter," says Rob Larsen, a program manager at Draper. "I can pitch the robot like a baseball through a window. As soon as it hits the ground, it begins relaying video and audio." Essentially, a throwable bot gives a soldier X-ray vision and superhuman hearing. Says Larsen: "Troops now in the jungles of the Philippines would be able to know what's ahead of them with this technology."

The first throwable robot effort, funded by Blitch's TMR program, culminated in Spike – a grapefruit-sized bot that slides open and extends spiked wheels on command. Spike had no onboard sensors or processor and had to be teleoperated by a soldier using a wireless joystick.

Now, with funding from a different Darpa program, Draper is working on a more intelligent device called the high-mobility tactical microrobot, or HMTM. Larsen plans to have a prototype ready for Darpa in December and aims to supply a $5,000 battle-ready model within three years. But first, his team must devise a way for the HMTM to handle conditions as varied as mud, gravel, and water. One possible solution uses a hybrid motion system that switches between tanklike treads and wheels depending on the terrain. Larsen also needs to ensure that the device will be able to withstand repeated drops onto pavement. To that end, he's developing special impact-resistant materials to fortify the housing, wheels, chassis, and drivetrain.

In the meantime, the Draper group has written custom software that can compress video in real time. This feature will be particularly important when Larsen converts the communications system from its current 802.11b protocol to cellular, which can cover a broader geographical area (and is more suitable in remote locations) but operates over a narrower slice of bandwidth. No wireless system is 100 percent dependable, though, so Larsen is developing a homing instinct that he calls automatic retrotraverse. An onboard sensor tracks the HMTM's heading and wheel rotation. If the network fails, the robot can play back its movements in reverse, retracing its steps until communication is reestablished. "This will save the robot if the communication link with the operator drops out or is jammed," says Larsen. "It could spell the difference between mission success and failure."

The throwable microbot in development would give a soldier X-ray vision and superhuman hearing.

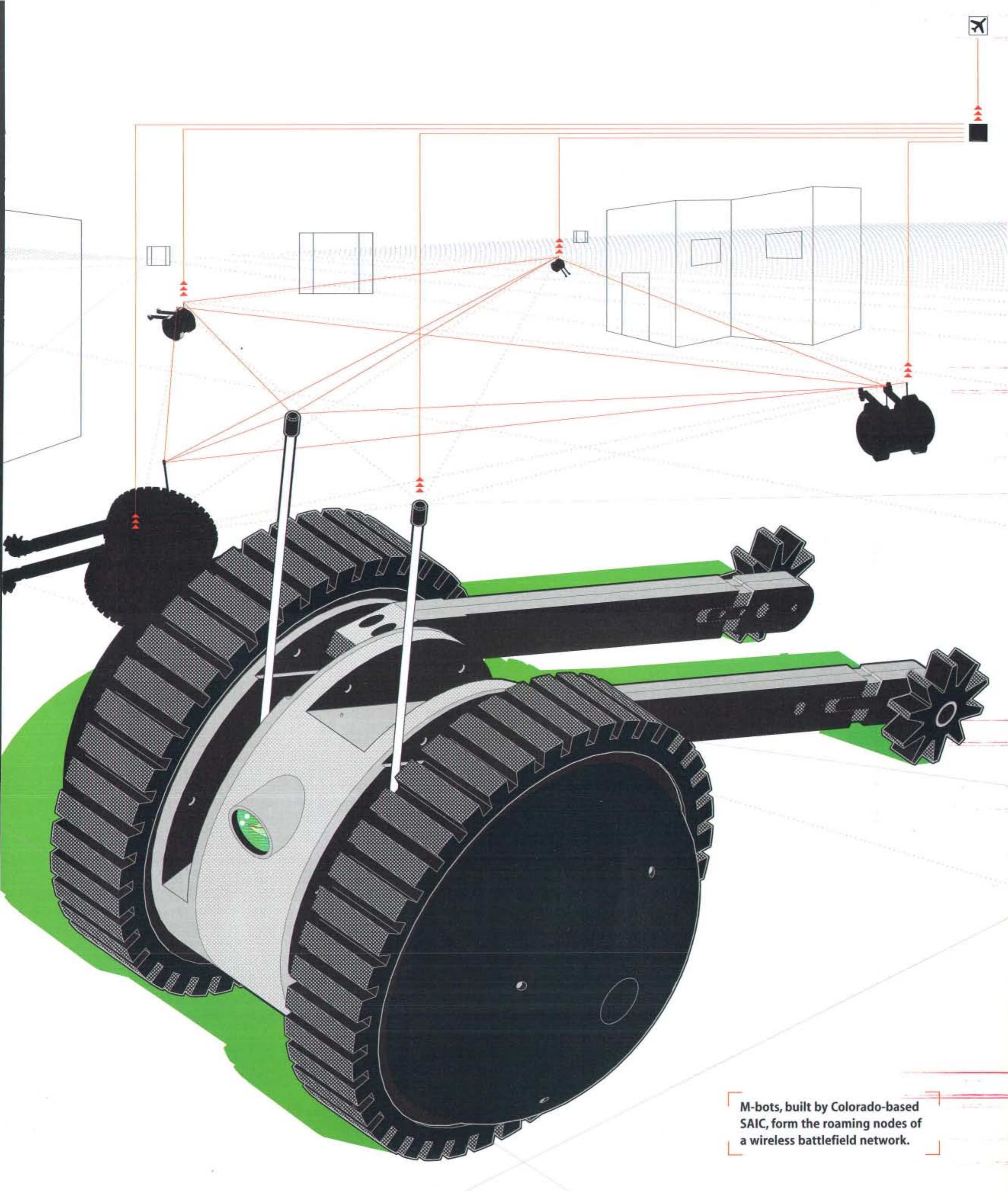
A few miles from Draper Lab, at an MIT spinoff called iRobot, researchers are developing another promising TMR: the PackBot. It looks like a miniature tank stripped of its gun turret and stands out for both its agility and versatility. The general-purpose TMR can be used as a workhorse vehicle for hauling ordnance or as a mobile first-aid station, dashing into battle with a cartload of medical supplies. In one video demo, the PackBot rescues an injured soldier lying between two buildings as bullets whiz overhead. The PackBot zips to his side, dragging a stretcher. The soldier rolls onto it. Medics, holed up in a nearby bunker, grab a tether attached to the stretcher and pull it to safety. In another clip, the PackBot ascends a flight of stairs in a couple of seconds. The iRobot engineers are working on teaching the PackBot to ford a river after looking for shallow water or protruding stones.

The robot is also wired for reconnaissance missions. "It has six payload sockets," says project manager Tom Frost. Each robot can handle 12 video sources, six Ethernet connections, eight USB ports, digital signal processing, and eight power supplies. A 700-MHz Pentium III with 256 Mbytes of memory, 300 Mbytes of storage, and two video cards crunches incoming sensor data. Finally, a digital compass and a GPS receiver keep the PackBot on course when it's in the field.

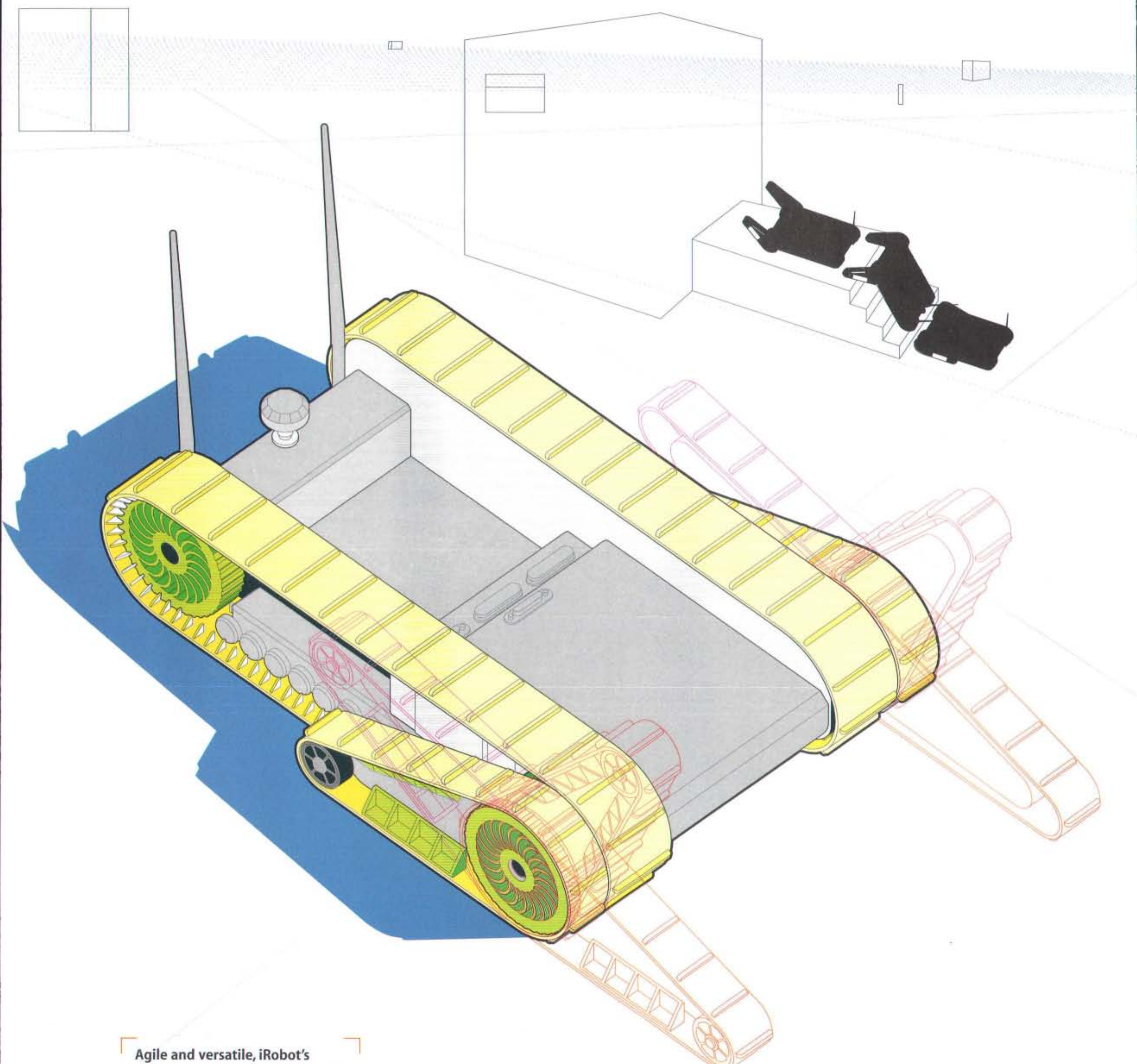
This summer, iRobot will deliver up to 15 PackBots – running $20,000 to $50,000 each – to the Department of Defense, which will distribute the machines for testing by various groups within the military.

The PackBot, the HMTM, and all of the SAIC devices were funded by Darpa and guided by what those in the industry know as Blitch's Five Imperatives:

Michael Behar (michael@michaelbehar.com), *a former senior editor at* Wired, *writes about science and technology in Washington, DC.*



M-bots, built by Colorado-based SAIC, form the roaming nodes of a wireless battlefield network.



Agile and versatile, iRobot's all-purpose PackBot can ascend a flight of stairs in seconds.

A TMR must be able to get back on its feet when it has fallen. It must be able to recover from communication loss. It must know where it is. It must be tamper-proof. And it must be able to maneuver around complex obstacles.

According to Blitch, no single tactical robot meets all five imperatives yet. But he has seen a steady evolution. "First you had radio control," he says, "where there was a full view of the vehicle at all times, and you dictated its every move." Next came tele-assisted bots, which are still guided by a human but can venture out of sight because they employ video, audio, and other sensory feedback. Tele-operated units can maneuver independently, asking questions only when they are confused. The final step, says Blitch, is complete autonomy, meaning that the robot will carry out a mission according to a set of predefined parameters, without step-by-step human guidance.

Watch Raptor move around the SAIC parking lot – controlled by Jim Hamilton and a laptop, and chased by an engineer ready to yank out the power cord if things go wrong – and you know that complete autonomy is a few years away. Currently, a typical TMR requires three or four handlers. Ultimately, researchers want to invert the ratio, allowing one soldier to control multiple autonomous robots. "Then you've achieved force multiplication," says Ron Arkin, a professor of artificial intelligence, computer vision, and mobile robotics at Georgia Tech who's written software for the Darpa program. "You could have 10 people on the battlefield doing what once took 40 soldiers."

The PackBot would have been handy at Hue City, says a vet – or scouting Vietcong tunnels.

The biggest challenge between, say, the PackBot and complete autonomy is software. It's easy enough to add another sensor; it's much harder for the robot to know how to interpret the data that sensor collects *and* how to integrate it with other incoming data. A tactile sensor, for instance, can "feel" uneven terrain using a series of predetermined algorithms. When the TMR discovers it's driving over rough ground, it reduces speed. Now, imagine that while the bot's sensors are detecting and responding to the surface, other sensors realize that the robot is being shot at. Should it continue slowly or speed away?

Hamilton is developing a software suite that can accept input from dozens of sensors and decide on the best course of action. Analogous to the human brain, ATAC (autonomous terrain adaptive classifier) employs an arbitrator that examines the incoming data – which might indicate gunfire, darkness, water, bioweapons, or irregular topography – and decides whether to stay and fight or run for the hills. When Hamilton sketches ATAC's decisionmaking process onto a whiteboard in the SAIC conference room, the diagram resembles the schematics of a Ponzi pyramid. At the base, there's an array of sensors, each uploading data to the next level. A more sophisticated bank of sensors at the pyramid's midsection sifts through the raw data and generates a finite set of directives. Finally, at the top, ATAC evaluates the refined readings and makes an "educated" judgment.

There are plenty of critics who doubt that software solutions like ATAC will match the decisionmaking power of the human brain anytime soon. "Autonomous robotic weapons won't demonstrate human intelligence until machines pass the Turing test," says Ray Kurzweil, author of *The Age of Spiritual Machines*. Other naysayers point to more basic hardware problems that must be solved. Most TMRs are smaller than tanks and less agile than humans, which can turn a molehill into a mountain. "The current wheel and track technologies are going to run into limitations," says Prasanna Mulgaonkar, the director of SRI's Advanced Automation Technology Center. He proposes a biomimetic solution: They could hop or slither or fly. Power is another stumbling block, which Georgia Tech's Arkin hopes fuel cells might solve.

"I still have not seen anything that can go where I had to go in Vietnam," says Bill McBride, a retired Marine lieutenant colonel who ran reconnaissance missions along the DMZ. McBride is a principal engineer at the Southwest Research Institute in San Antonio, Texas, where he runs the country's only independent test facility for tactical robots

Evaluators race the robots in circles on a 6,000-foot paved track until the bots either break or run out of juice. "Only when they survive the on-road track do we take them on the harder stuff," says McBride, whose offroad course includes a variety of mud bogs, water obstacles, steep culverts, rock beds, and a series of movable ramps covered with sand, gravel, and loose pipes. With each successive generation of tactical robots, McBride adds new challenges to the course. He's developing an experiment that will test how well the robots can avoid detection by a pack of aggressive dogs.

"In order to fit a TMR in your pack, you have to take out something – like ammunition – so the trade-off better be worth it," says McBride, who seems skeptical that the machines will ever be good enough. Nevertheless, he admits that a PackBot might have been handy in the battle for Hue City, a bloody house-to-house fight that cost 142 American lives and left 847 wounded. "We took a lot of casualties just trying to cross the street," says McBride.

That thought is echoed by retired colonel Mac Dorsey, who's now a program manager at Systems Planning Corporation, which provides technical and logistics support to Darpa's TMR program. As Dorsey says, "Using robots to search Vietcong tunnels would have been a much better solution than the state-of-the-art technology at the time – a very gutsy soldier."

While useful for discrete tasks, robots will never replace the well-trained soldier. "I think of them in the way a soldier thinks of his rifle: If it helps him or her get the job done, great. If not, leave it at home and take something else," says Scott Fish, the program manager of Darpa's Tactical Technology Office.

Blitch agrees that robots will never replace humans. "We are risk junkies," he says, arguing that soldiers want to be thrown into danger, not kept out of it. Still, looking at the TMRs in development today and listening to the scenarios of Blitch and other researchers, it's easy to imagine battlefields where soldiers are rarely placed in harm's way. And that makes you wonder whether we will be more inclined to go to war knowing there's less chance of losing human lives. When I ask Blitch if the robots will encourage violent solutions to political conflicts because – like the cruise missile or B-2 stealth bomber – they'll disengage us from killing, he falls uncharacteristically silent.

"A robot is not a weapon," he says, after a moment or two. "It can save someone from a sniper's bullet or be used to clear land mines all over the world." That's not to say that he doesn't wake up at night with visions of *Terminator 2* replaying in his mind. "Creating machines to fight wars might indeed create more war … even robot wars," he says. "And I don't want to go down in history as the father of weaponized robots."

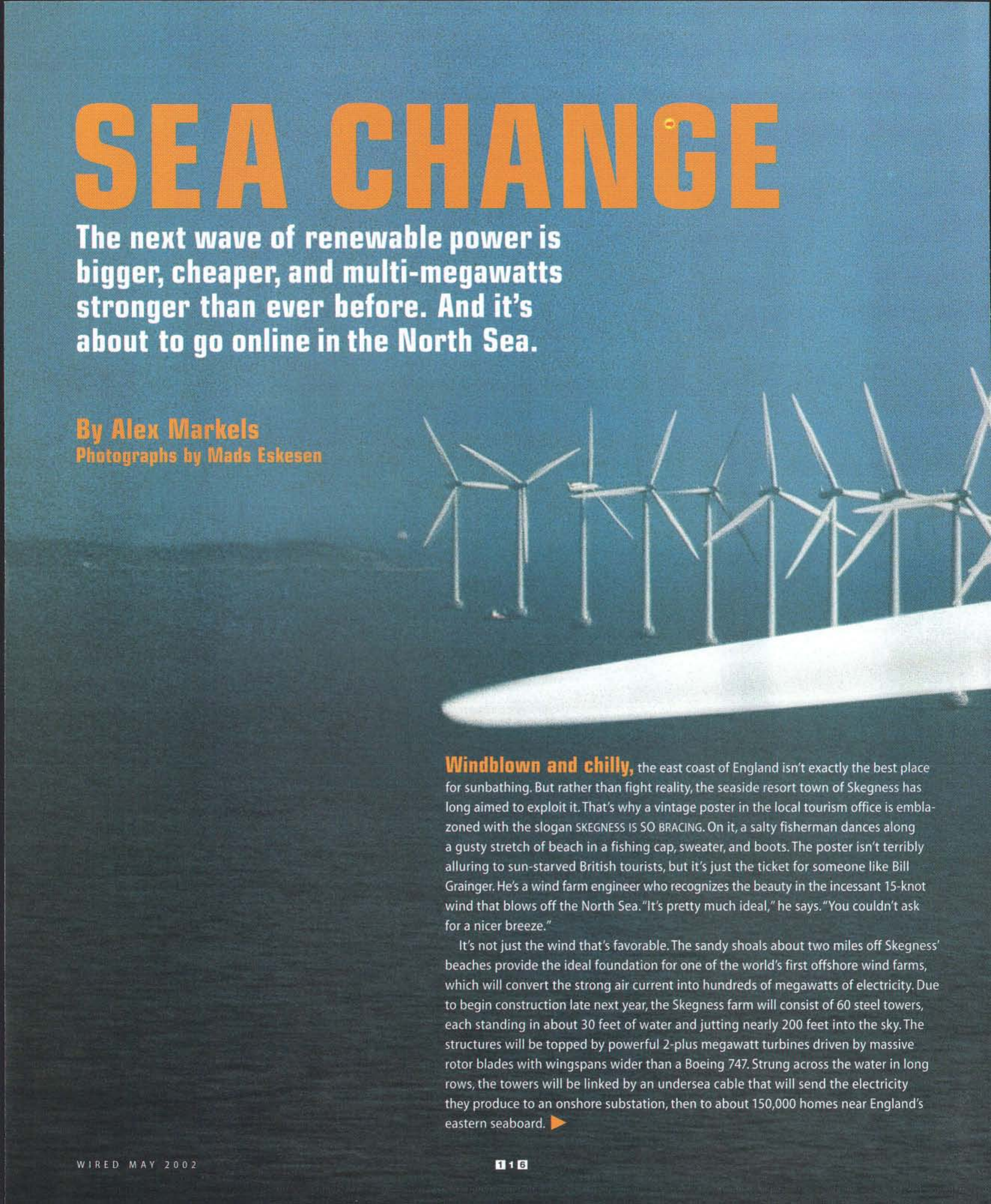
In fact, he may go down in history as the first soldier to put tactical mobile robots to the test. In mid-January, four months after his unauthorized, post-retirement mission at the World Trade Center, Blitch was called back into active duty – with orders to assemble a team of robots for the mission. ■ ■ ■

SEA CHANGE

The next wave of renewable power is bigger, cheaper, and multi-megawatts stronger than ever before. And it's about to go online in the North Sea.

By Alex Markels

Photographs by Mads Eskesen



Windblown and chilly, the east coast of England isn't exactly the best place for sunbathing. But rather than fight reality, the seaside resort town of Skegness has long aimed to exploit it. That's why a vintage poster in the local tourism office is emblazoned with the slogan SKEGNESS IS SO BRACING. On it, a salty fisherman dances along a gusty stretch of beach in a fishing cap, sweater, and boots. The poster isn't terribly alluring to sun-starved British tourists, but it's just the ticket for someone like Bill Grainger. He's a wind farm engineer who recognizes the beauty in the incessant 15-knot wind that blows off the North Sea. "It's pretty much ideal," he says. "You couldn't ask for a nicer breeze."

It's not just the wind that's favorable. The sandy shoals about two miles off Skegness' beaches provide the ideal foundation for one of the world's first offshore wind farms, which will convert the strong air current into hundreds of megawatts of electricity. Due to begin construction late next year, the Skegness farm will consist of 60 steel towers, each standing in about 30 feet of water and jutting nearly 200 feet into the sky. The structures will be topped by powerful 2-plus megawatt turbines driven by massive rotor blades with wingspans wider than a Boeing 747. Strung across the water in long rows, the towers will be linked by an undersea cable that will send the electricity they produce to an onshore substation, then to about 150,000 homes near England's eastern seaboard. ▶

"And that's just the beginning," says Grainger, who is a project manager for AMEC Wind, one of more than two dozen energy companies racing to construct offshore wind farms throughout Northern Europe's coastal regions. The Skegness site is one of 18 farms that will soon surround the British Isles, part of an aggressive scheme to wrest at least 12 percent of Europe's energy needs from wind and other renewable sources within the next eight years. Spurred by concerns over climate change and the United Nations Kyoto Protocol agreements to reduce fossil fuel emissions, the European Commission has called upon the nations of the European Union to increase their use of renewables. Member states, in turn, are obligating their public utilities to do the same.

Offshore wind farms are expected to supply a significant part of the increase, thanks largely to technological advances that have finally made the sea-based systems economically feasible. These include new high-output turbines, dynamic power controllers, and more efficient blades. The result is that wind has become the most economical of the clean energy sources – with a cost per kilowatt-hour that has fallen by 85 percent in the past 15 years.

"These things will get very big": The race to supersize has already produced a 3.6-megawatt turbine. Next up: 5 megawatts, then 10.

Even so, it remains about a third more expensive than fossil fuels, so European governments are offering financial incentives to utilities and other energy companies that develop offshore wind farms. A combination of favorable electricity purchase contracts, low-cost leases, and tax breaks have helped persuade a variety of companies to get involved, among them power producers, offshore drilling suppliers, shipbuilders, and turbine manufacturers. Large-scale projects in Denmark and the Netherlands are already up and running, including a 40-megawatt installation at Middelgrunden, just off the coast of Copenhagen. And new construction in Ireland, Germany, and Britain is due to put scores of farms in the water over the next five years. In the United States, Cape Wind Associates aims to build a 420-megawatt farm in Nantucket Sound by 2005.

For its part, the UK's Department of Trade and Industry has promoted a plan to install 6,000 or more high-output turbines off Britain's shore; if clustered together, they would fill an area of seabed roughly the size of London. Last year, the Crown Estate, a government-affiliated trust that oversees the coastal waters, inked agreements with 18 energy firms to lease the 18 sites. The government kicked in $100 million in capital grants – about 7 percent of the farms' total cost – and is finalizing regulations to require public utilities to purchase electricity from them.

The UK sites are now undergoing environmental and geologic studies to determine the best spots to position the towers. Construction is set to begin in the summer of 2003. When completed, the farms will generate about 1,600 megawatts, enough to replace two of Britain's nuclear power plants (several of which are slated for shutdown soon) and feed electricity to 1.1 million homes.

"We've got the windiest coastline in Europe," says John Doddrell, director of sustainable energy policy for the Department of Trade and Industry, "and we intend to take full advantage of it."

Renewable energy proponents have long eyed Northern Europe's vast coastal shallows in the hope of harvesting the region's wind resources. Devoid of obstacles to block or slow it, the North Sea region's wind energy is about 50 percent greater offshore than on land, according to the European Wind Energy Association. Offshore airstreams are also less turbulent than those onshore, improving turbine efficiency and reducing wear and tear on the machinery. Yet until recently, turning sea breezes into electricity just wasn't economical.

"When we started to investigate offshore wind energy in the late 1970s, the biggest turbines could generate only about 10 kilowatts each," recalls Nick Goodall, executive director of the British Wind Energy Association, a nonprofit trade group. "To meet the demand for electricity, we would have had to install hundreds of thousands of towers, which was completely unreasonable."

Since construction costs on land were lower, the economics were more favorable to terrestrial systems. So wind farm developers in Britain focused on building in the country's gusty highlands. Trouble was, in densely populated areas where available real estate is in painfully short supply, their projects often butted up against private landowners: Neighbors objected to the windmills' noisy operations and tried to put the kibosh on any new ones.

But the largest hurdles were the limitations of the technology itself. Early systems were plagued with design problems that kept most from generating electricity more than half the time. Poor aerodynamics caused the towers

Blade runners: A rotor with a wingspan wider than a 747 is transported by barge. England's Mayflower Energy expects to install one turbine a day by year's end.

to shake under severe wind loads. Inflexible rotor blades cracked and fell off. Generators burned out. "[The old turbines] required a lot of maintenance and suffered a lot of downtime," says Sandy Butterfield, chief wind engineer for the US Energy Department's National Renewable Energy Laboratory in Golden, Colorado. "That didn't exactly make them economical."

First developed in the United States during the 1970s, and fueled by government subsidies and tax credits as a result of the energy crisis, wind farms enjoyed a short-lived boom in the US and Northern Europe. But as energy prices stabilized and governments withdrew funding, the fledgling industry went all but bust. An exception was Denmark, which continued to subsidize the industry and eventually established a long-term target of generating 50 percent of the country's electricity supply with wind-based systems. Turbine manufacturers there continued to advance the technology. And when demand finally returned in the 1990s amid higher oil prices and growing environmental concerns, the Danes found themselves in a position to dominate the market.

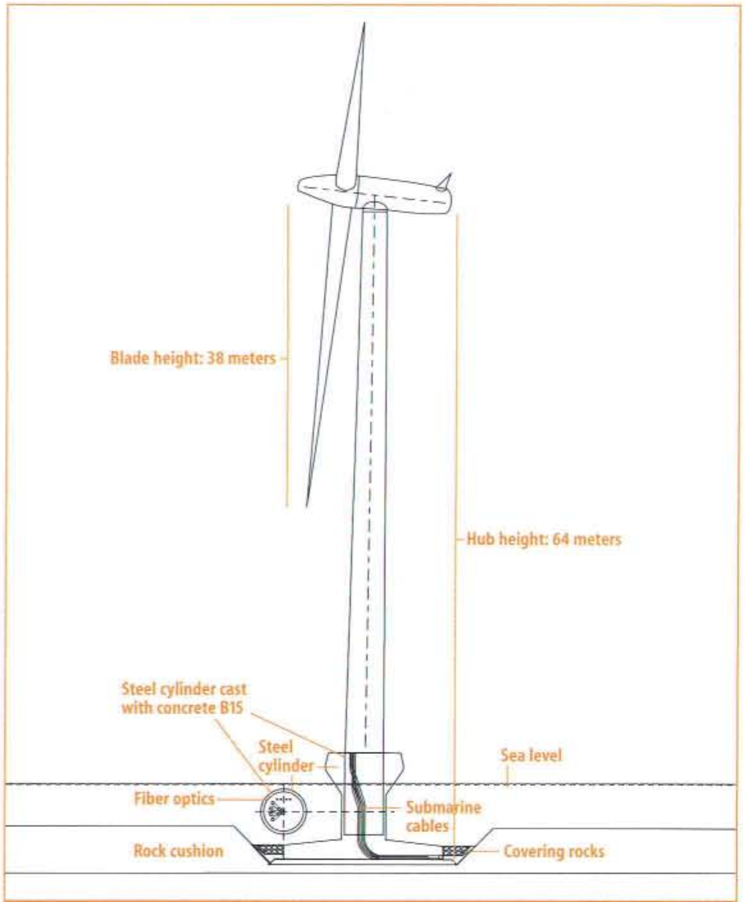
Today, Denmark is the world's leading supplier of wind energy systems – and one of its most dedicated consumers. It generates more than 2,500 megawatts from wind, about 13 percent of its total electricity usage. Four of the five largest manufacturers are Danish, among them Nordex A/S, maker of a 2.5-megawatt system, the world's biggest. Last year, Nordex announced plans to build a 5-megawatt generator for offshore applications – more than twice as powerful as the ones off Skegness.

The newest turbines aren't just more powerful than their predecessors, they're more efficient and reliable. With the help of design software, engineers can devise towers and components that match the wind loads they must withstand. New manufacturing methods have also yielded rotor blades that are lighter and more flexible. This reduces the dynamic loads on the supporting tower, drivetrain, and generator housing, lowering construction costs and easing the stress on the components.

"The quality of the engineering has taken major leaps," says NREL's Butterfield. "It used to be that two mechanics would be able to keep 10 machines running. Now those same two guys can look after 100 machines, and much bigger ones at that."

Meanwhile, advances in microprocessors and power electronics – which employ semiconductors to convert electricity from direct to alternating current – have helped ease the integration of wind farms into power grids. The new line of wind systems incorporates two microprocessor-driven controllers to ensure that variable wind speeds yield a stable electrical output.

Such improvements have lowered the cost of delivering wind-based electricity by about 25 percent in the past five years, while also decreasing the turbines' downtime. "We're approaching 98 percent availability, which means we can produce electricity pretty much whenever the wind is blowing," says AMEC's Grainger. "That's exactly what we needed to make offshore wind farms feasible."



Tower of power: today's working standard turbine, by Copenhagen Energy.

With the technology finally at a tipping point, wind farm proponents are set to construct large sea-based systems capable of delivering hundreds, even thousands, of megawatts. The decision to go big is an economic one. While the size of onshore farms is limited by the availability of open land and tolerant neighbors, offshore systems have no such constraints. Nor do their builders need worry about transporting huge towers and rotor assemblies along highways or under bridges. In fact, because the cost of the tower structures remains relatively fixed regardless of turbine size, offshore developers can realize substantial economies of scale by incorporating the largest turbines possible. That has triggered a race among manufacturers to design supersized wind systems.

"The jury is still out on the optimal size for offshore, but it's entirely conceivable that you could see a 10-megawatt turbine on the market within the next few years," says Bob Gates, senior vice president at Enron Wind, an independent Enron subsidiary that's being acquired by General Electric. The company recently introduced a 3.6-megawatt turbine for use off the coast of England in an area known as Gunfleet Sands. "These things are going to get very big."

That's just the size the offshore construction industry is used to handling. Adapting the skills and equipment that have been employed for decades to create deep-sea oil and gas rigs, at least two firms plan to enter the market this year. England's Mayflower Energy, for example, will soon complete a 400-foot vessel that will be the first specifically designed to construct offshore wind farms. Equipped with six submersible "jack-up" legs to stabilize the ship and a massive crane to position the towers, the vessel can hold up to 10 turbine assemblies on what amounts to a floating factory. "We expect to be installing about one turbine a day by year's end," says Paul Gibson, business development director for Mayflower. The company, which is considering putting up its own farm, plans to produce as many as six additional ships to meet the growing demand throughout Northern Europe. "We've surveyed the market and it seems that things are just ready to take off. This is clearly the wave of the future."

And you can't build a big wave without a strong gust. ■ ■ ■

Alex Markels (alexmarkels@earthlink.net) *wrote about Sea Launch in* Wired *9.04.*

Wanna Bet?

Seventeen of the world's most wired minds stake their names – and their cash – on the future.

PRONOUNCEMENTS about the future come easy. Even when made with an air of authority, they're usually just cheap talk, rarely revisited. Only the tiny fraction that have proven correct tend to be remembered, when their authors want to take credit.

But what if there were some cash at stake?

The Long Bets Foundation, a new project masterminded by Well founder Stewart Brand and *Wired* editor at large Kevin Kelly, hopes to raise the quality of our collective foresight by incorporating money and accountability into the process of debate. The idea is simple. If someone makes a grandiose claim, any skeptic can challenge it – "Would you bet on that?" – and the Long Bets Foundation will keep tabs on the wager, whether it takes five years or five decades to come to pass. If proven right, a predictor can relish the victory; if wrong, the challenger gets the glory.

By preserving the terms of the wager in public view, Long Bets promises to be more than a service for confident prognosticators. Over time, it hopes to foster better understanding of how predictions in aggregate work out in reality – what kinds of truths are easiest (or hardest) to forecast, and what kinds of people are right (or wrong) most reliably.

Following are the first-ever "long bets." According to the Long Bets Foundation, all stakes are treated as charitable donations, tax deductible when the bet is made. Bettors designate nonprofits to receive the proceeds. Meanwhile, the foundation holds the funds in an investment account for the life of the bet, with half of the growth covering administrative costs. A competition designed to thrive in the public eye, Long Bets uses time as a teacher. ■ ■ ■

Commercial airline passengers will routinely fly in pilotless planes by 2030.

YES

Craig Mundie

CTO, Microsoft

DESIGNATED NONPROFIT:

Lee Hartwell Innovation Fund at the Fred Hutchinson Cancer Research Center

"My logic goes like this: First, we have planes today that can take off, fly, and land without a pilot. Pilots are there only in case something untoward happens. Second, we already have remotely controlled aircraft, which we've seen, for example, in the Afghanistan war. Third, computers themselves, over the next 18 years – if we stay on this Moore's law kick – will be about 4,000 times more powerful than they are today.

The next step in this logic is that with computers increasingly a part of critical infrastructure, the industry is going to have to focus a lot more on making machines that just don't fail. If we go at that hot and heavy for five or 10 years, I imagine arriving at a methodology for system design that yields as much dependability, on an everyday basis, as the triple-redundant computer that flew guys to the moon. Finally, air traffic control will no longer be based on staticky communications with people staring at radar screens; it'll be completely computerized."

THE STAKE

$1,000

NO

Eric Schmidt

CEO, Google

DESIGNATED NONPROFIT:

Chalk (Communities in Harmony Advocating for Learning and Kids)

"Even though the technology to take off, cruise, and land automatically already exists, no licensed air carrier (commercial or private) by 2030 will be able to fly without at least one pilot – in the pilot seat – supervising the whole process. On takeoff, the training and timing for handling emergencies such as engine failure are not going to be transferable to autopilots and machines. On landing, automated airplanes would have to sequence in with many older airplanes piloted by humans. Towers and air-traffic controllers love to change everything at the last minute, and adding the ability to make changes by computer while simultaneously using voice is not realistic. Finally, the FAA changes so slowly that if pilotless travel like this were at all possible, the adoption and certification would take at least 50 years."

BACKGROUND

Although the United States military has used "drones" since World War I, commercial pilots scoff at the notion of Mom and Suzie boarding pilotless DC-10s. A joke in the industry says that folks might be happy enough with the innovation until they settle into their seats and hear, "This is your pilot speaking, speaking, speaking, speaking…" But the comfort test – not only *is* it safe, but does it *feel* safe? – evolves as technology does. Mundie is betting that airplanes, traffic control, and communications technology will improve enough to eliminate fatal glitches and offer fliers adequate reassurance. Schmidt, a pilot himself, begs to differ.

PHOTOGRAPH RIGHT: MICHAEL SPRINGER/ZUMA PRESS

By 2010, more than 50 percent of books sold worldwide will be printed on demand at the point of sale in the form of library-quality paperbacks.

YES

Jason Epstein

Former editorial director, Random House; author, *Book Business: Publishing: Past, Present, and Future*

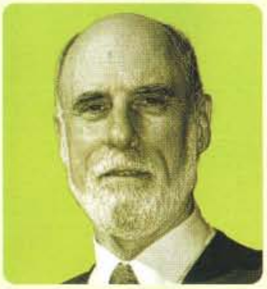
DESIGNATED NONPROFIT:

New York Public Library

THE STAKE

$1,000

NO



Vint Cerf

Vice president, WorldCom

DESIGNATED NONPROFIT:

Internet Society

"I'm confident that print on demand is the future of the book business. Used at the point of sale, new POD technology – like a prototype developed by Marsh Technologies – will have fully integrated components and a cost of about $100,000 per unit.

Nothing is as inexpensive, easy to carry around, and indestructible as a physical book. And readers don't want to have texts augmented with sound and pictures and all sorts of other things; you're supposed to imagine all that when you read – that's what the writer's there for. Plus, habits don't change that quickly. If you're in business, you have to approach the market as it is, rather than as it might be, or should be, or will be someday."

"Carrying around a bunch of paper is unnecessary. Despite the argument that a traditional book doesn't need a battery or a recharge, I believe that it will be very common for people to read for work and for pleasure with the same electronic devices they use daily.

Books aren't going away, of course. But at some point laptops, or smaller devices with high-quality displays and suitable access controls for intellectual property, will make the sale and consumption of books, sound, and movies practical. Apple's iPod offers an example. I'm betting that by 2010, 50 percent of books will be delivered electronically."

BACKGROUND

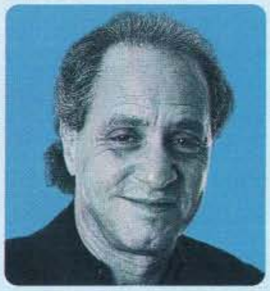
It's only a matter of time before the entrenched book publishing industry undergoes fundamental change. Amazon successfully overhauled book ordering, marking the first giant leap away from business as usual. Since then, wholesaler Ingram has begun filling custom orders as small as one unit, and online publishers such as Xlibris and 1stBooks now provide thorough services intended to sidestep the big-name publishers. And more upheaval is coming: Book business expert Epstein believes it'll take the form of wireless, Web-based bookstores at airports and corner markets worldwide; equipped with trimmers and binding devices, these kiosks will dispense texts much like ATMs spit out money. But Net pioneer Cerf thinks otherwise. It'll be ebooks, he says, that will truly overturn the staid old industry. If downloadable files are reader friendly on a computer screen, why waste paper?

PHOTOGRAPHS FROM LEFT: AP PHOTO/JIM COOPER; EVAN KAFKA

A computer will pass the Turing test by 2029.

YES

Ray Kurzweil
Author, entrepreneur, technologist
DESIGNATED NONPROFIT:
Kurzweil Foundation



"Scientists have already reverse-engineered two dozen of the several hundred regions of the human brain; we'll understand its principles of operation and be in a position to re-create its powers in synthetic substrates well within 30 years. But we won't program human intelligence link by link in some massive expert system. Nor will we simply set up a single genetic algorithm and have intelligence at human levels automatically evolve itself. Rather, we will set up an intricate hierarchy of self-organizing systems, based largely on the reverse-engineering of the human brain, and then provide the computer entity with an education, which, given the increasing power of machines, can proceed hundreds if not thousands of times faster than the comparable process for humans."

THE STAKE
$10,000

NO

Mitchell Kapor
Founder, Lotus; angel investor
DESIGNATED NONPROFIT:
Electronic Frontier Foundation

"Each of us knows what it is like to be in a physical environment; we know what things look, sound, smell, taste, and feel like. Such experiences form the basis of agency, memory, and identity. Without human experiences, a computer cannot fool a smart judge probing its ability to communicate about the quintessentially human. In the past, scientists have employed metaphors to characterize mysteries of human functioning – the heart as pump, the brain as telephone switchboard. My prediction is that contemporary metaphors of brain-as-computer and mental activity-as-information processing will in time also be superseded and will not prove to be a basis on which to build human-level intelligent machines – if indeed any such basis ever exists."

BACKGROUND

In 1950, mathematician Alan Turing conceived of a test that would determine whether a machine had demonstrated human-level intelligence. The players: a computer, a human foil, and a judge. Conversing via text on matters of art, science, nature, and personal experience, the judge attempts to discern which is the living person and which the machine. To fool the judge is to pass the test.

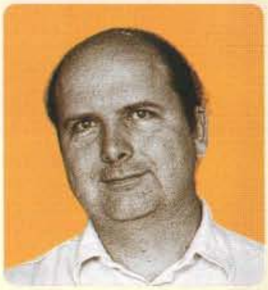
But imagine this experiment conducted in 2029, and you run into a few problems – Kurzweil and Kapor, for the purposes of their bet, have carefully addressed these. First, they've agreed, the human decoy must be all human – no neural implants, no genetic enhancements. Second, the computer has to be a computer – no biological neurons allowed. The machine is permitted, however, to invent its own life story.

PHOTOGRAPHS FROM LEFT: CHAD WINDHAM; GLOBE NEWSPAPER COMPANY INC.

The universe will eventually stop expanding.

YES

Danny Hillis
Cochair and CTO,
Applied Minds
DESIGNATED NONPROFIT:
Long Now Foundation



THE STAKE
$1,000

NO

Nathan Myhrvold
Copresident and cofounder,
Intellectual Ventures
DESIGNATED NONPROFIT:
Institute for Advanced Study

"I don't believe the measurements that show the universal expansion is accelerating. There's a long chain of evidence leading up to that conclusion, and I suspect a mistake somewhere in that chain. We have to do an awful lot of extrapolating when we measure things like the redshift of supernovas at the edge of the universe, and I don't think we have things so neatly figured out. What if light actually loses energy as it propagates over long distances? That would throw off redshift measurements entirely. There's a lot of room for surprises. We already know there are all kinds of dark matter, and there may be varieties of dark energy out there, too – maybe one that's pushing in the other direction. What I'm really betting on is that the universe will turn out to be complicated in directions we have not even figured out yet. Not only is the world more interesting than we expect, it's more interesting than we *can* expect. Also, cosmology is subject to fads: If I'd bet at any point that the current scientific consensus was wrong, I'd have been right."

"I think the evidence is pretty consistent that we're going to end up in a cold, dark universe. The reason to believe in a closed universe is either because you want to be contrary or because you subscribe to an aesthetic notion of cosmology. It's kind of cool to think of the whole thing expanding and contracting, throbbing there for all time. But appealing or not, most estimates about the pressure and critical mass of the universe right now have me winning. First, empirically, we have the fact that the universe is expanding. Also, over the past 20 years, astronomers have developed very clever, indirect ways of finding dark matter, and they've discovered that there isn't nearly enough to collapse the universe – not by a factor of 10. Finally, there are theories in cosmology that embrace the idea that the universe is a random accident, like a bubble in a bottle of fizzy water. In that scenario, bubbles like our universe form, and they expand, and they go away. Take the evidence together and I think I've got the upper hand."

BACKGROUND

In the 1920s, Edwin Hubble discovered that the universe was expanding, galaxies and stars moving away from one another like spots on an inflating balloon. Whether this expansion would go on forever or at some point reverse itself became a point of debate among physicists. Initially, the dispute hinged on two factors: the rate of expansion (astronomers measure this by looking at the redshift of distant galaxies), and the total mass of the universe, including the large, invisible component dubbed "dark matter." If the total mass were great enough, gravity would slow and eventually reverse the growth, collapsing the cosmos back in on itself. Then, in 1998, new measurements revealed that the universe was not only expanding but accelerating; a mysterious force, which scientists called "dark energy," seemed to be pushing it apart faster and faster. Myhrvold believes that this discovery, among others, guarantees that the universe will expand forever – and most of today's astrophysicists would agree. Hillis, on the other hand, notes that dark energy is an enigma – no one knows what it is or what its properties are – and might be an early sign of trouble with cosmology theory as a whole.

PHOTOGRAPHS FROM LEFT: AMANDA FRIEDMAN; AARON CAPLAN

A Brief History of Betting on the Future

By Kevin Kelly

SEVEN YEARS AGO in the pages of *Wired*, I made a $1,000 bet with self-described neo-Luddite Kirkpatrick Sale. I was irked by his assertions of the coming collapse of civilization-as-we-know-it, and I challenged him to bet on his prediction that by 2020 we will suffer the convergence of three disasters: a global currency collapse, significant warfare between rich and poor, and environmental problems that render whole continents unlivable. The bet forced both of us to refine strongly held beliefs, and because our predictions were now public, our reputations were on the line. On the judgment date of our bet, my ideology or his will gain credence.

This is what public wagers can do: sharpen logic, filter out the halfhearted. Sometimes they can even alter collective views and shape society.

In 1980, biologist and ardent environmentalist Paul Ehrlich was so certain that natural resources would become scarce and expensive that he publicly bet iconoclast Julian Simon that the price of five mineral commodities (copper, chromium, nickel, tin, and tungsten) would rise in 10 years. In fact, by 1990 prices had plummeted by almost half, and Simon won the bet easily. Simon was a prolific skeptic of environmentalism, yet nothing that he ever wrote had as much impact on the course of culture as his wager with Ehrlich. That single, relatively small bet transformed the environmental movement by casting doubt on the notion of resource scarcity.

In the world of science, making a bet is a customary form of accountability. The earliest scientific wager on record was between the astronomers Johannes Kepler and Christian Longomontanus in 1600. Kepler bet his arch rival that he could derive the formula for the solar orbit of Mars in eight days. He lost. Although his slow calculations were correct and spawned modern astronomy and physics, they took him five years.

Since then, betting on future discoveries has been rampant among scientists and technologists. Robin Hanson, an assistant professor at George Mason University, has set up a prototype market where bettors back scientific ideas as a way to inform and guide research funding. He imagines these as "idea futures," much like corn futures "except that you bet on the settlement of a scientific controversy instead of the price of corn." But whereas Hanson's market involves no actual exchange of money, many bets involve real stakes. Maurice Goldhaber, a particle physicist, bet a colleague $500 that his brother Gerson, also a particle physicist, would never find the antiproton he was looking for, because it did not exist. Maurice lost. And so did Nobel laureate Edwin McMillan, who made the same bet against particle physicist Emilio Segre. (The antiproton was discovered in 1955.) The historian Allan Franklin counted at least three wagers on whether left-right symmetry (parity) is maintained in subatomic reactions. In 1957, researchers determined it wasn't, and one of the notables who lost this contest (at 50-1 odds) was the legendary physicist Richard Feynman.

Cosmologist Stephen Hawking has made a number of high-profile wagers on future discoveries. In 1975, he bet Kip Thorne a subscription to *Penthouse* (the loser would get it mailed to his home) that a celestial mystery named Cygnus X-1 would turn out to be a black hole. It didn't. In 1991, he again lost to Kip Thorne, betting $140 and a T-shirt "embroidered with a suitable concessionary message" that a naked singularity could not exist. (A singularity is assumed to be the cosmic weirdness at the heart of a black hole; a naked singularity would be the weirdness of a point with infinite mass appearing outside the shell of a black hole.) Although no singularity, either naked or clothed, has ever been spotted in space, Hawking reluctantly conceded to Thorne in 1997 when Matthew Choptuik proved mathematically that the phenomenon was theoretically possible. Ever game, in December 2000, Hawking bet Gordon Kane

$100 that the Higgs Boson – labeled by headline writers as "the God particle" because it apparently gives matter its mass – will be discovered at the Fermilab Tevatron, the most powerful accelerator.

This kind of informal accounting of scientific forecasts often has subtexts. In the early 1980s, theorist Frank Shu bet observational cosmologist George Djorgovski 100 gallons of gasoline (at the tail end of the oil crisis, gas was precious) that, by January 1, 2001, theorists would have determined several cosmological constants (such as the density of the mass of the universe) to such high precision that the job of observers (like Djorgovski) would be simply to confirm the predicted value. Nearly 10 years later when things were looking especially good for the theorists, stubbornly optimistic Djorgovski made a parallel bet with David Spergel at Princeton. On the appointed day, the theorists had not prevailed. In a triumph for observation and empirical research, both Shu and Spergel conceded to Djorgovski. Shu paid up in wine of equal value to 100 gallons of gasoline.

Physics and cosmology are such quantitative fields that they readily lend themselves to wagers. And since it can take decades to build the high-priced gear needed to prove a theory, long-term betting is a way of dispensing credit for early insight. But other avenues of research have their share of bets. Early last year, two scientists studying the process of aging agreed to a $500 million bet on the world record for a human lifespan, now at 122 years old. University of Illinois at Chicago biologist Jay Olshansky bet that at least one person now alive will live to be 130, but no older. Steven Austad at the University of Idaho countered that the longest-lived person born in 2000 will make it to 150. If any 2-year-old today lasts till January 1, 2150, then Austad wins. Since neither Olshansky nor Austad expects to be around that long, a panel will adjudicate the contest and bequeath the prize to the bettors' heirs. And since neither scientist had $500 million on hand, each started a trust fund with $300, which according to their calculations should top $500 million in 150 years if the compounding is left undisturbed.

The value of responsible wagers on the future is so ingrained in some large research institutions that simple systems were created to track them. For several decades at the venerable Bell Labs in New Jersey, employees kept a book in which they recorded their gambles. It was sort of an office pool for geeks. Challenges ranged from bets on research findings to prognostications on the future of politics, public affairs, and the economy. Pierre Hohenberg, now at Yale, worked at the lab and added a bet or two to the book. "The stakes were always primarily symbolic – prestige among your peers – though since we were pitting our brains against those of our colleagues, it was not frivolous," he says. The book disappeared in 1990, without a backup copy, so earlier bets have vanished. Purloined by a sore loser? No one knows.

But at the Stanford Linear Accelerator Center, a similar accountability book lives on. *The Official SLAC Theory Group Record of Wagers* holds 33 pages with about 60 bets, the earliest dating back to 1985. It's an ordinary lab notebook, filled with scribbles and an occasional pasted-in email, documenting Ed Witten's bet against Michael Peskin, for instance, that the cosmological constant is, well, constant. At stake: "One dinner in an Indian restaurant better than the one in which the bet was made." Other bets, too good to pass up, draw additional players. Fifteen bettors signed up for this one: "By 1990, it will be well accepted that an elementary Higgs scalar particle does not exist." Five names for, nine against.

Biologists keep records of their speculations as well. David Stewart, a biochemist at Cold Spring Harbor Laboratory, oversees an old blue notebook that records the largest technical wager pool going. In this betting book, more than 400 scientists have put their money on what they believe will be the total number of genes in the human genome. The grand prize is called Genesweep. The winner will take the total pool (currently less than $500) and an autographed copy of the classic book *The Double Helix*. Guesses range from a low of 27,000 genes to a high of 312,000. DNA codiscoverer James Watson bet on 73,210 genes, while Francis Collins, head of the Human Genome Project, predicted 48,011. The first peer-reviewed tally in 2001 estimated the total to be around 30,000, cutting out both Watson and Collins as contenders. As the research is honed, scientists can make further wagers of $20. The final total is expected to be determined in 2003.

Betting on the future is more than just entertainment. It's also an engine for study, rigor, and planning. With each handshake since Kepler's, some bit of scientific thinking has been further refined. And remembered. The injection of real money into debates has weeded out brainless bragging, insincere speculation, and a tendency – particularly among losers – to forget. Captured in lab books and witnessed by colleagues, real long bets endure enough to instruct us. ■ ■ ■

Editor at large Kevin Kelly (kk@kk.org) *is cofounder of the Long Bets Foundation.*

The Long Bets Rules

- **The minimum bet is $1,000.**
- **The minimum period is two years. (No maximum period is set.)**
- **Odds are always even, and the result is always win/lose (no partial wins).**
- **The subject of the bet must be socially or scientifically important.**
- **Bettors provide an argument for why the subject is important and why they think they will win.**
- **Bettors target a charity they would like to see receive the proceeds of the winning bet.**
- **All bets can be viewed at *www.longbets.org*. Members of the public are welcome to make their own bets.**

Responsibilities of the Long Bets Foundation

- **To match bettors and develop sufficiently clear wording for the terms of their bets.**
- **To manage the originally tax-deductible stakes of the bets so that they grow over time (retaining half of the growth for costs of operating Long Bets).**
- **To distribute the winnings of each bet, taking into account the bettor's requested nonprofit. (To comply with tax law, the foundation cannot be legally bound to honor this choice.)**
- **To maintain annual contact with the bettors.**
- **To see whether the bettors, at the conclusion of the bet period, agree on the outcome, in which case the result is publicized and winnings delivered. If they do not agree on the outcome, the foundation will adjudicate the result.**

By 2012, Russia will be referred to as the world leader in software development in both *The Wall Street Journal* and *The New York Times.*

YES

Esther Dyson

Chair, EDventure Holdings; investor whose portfolio includes several Russian startups

DESIGNATED NONPROFIT:

Eurasia Foundation

THE STAKE

$5,000

NO

Bill Campbell

Chair, Intuit

DESIGNATED NONPROFIT:

Computer Museum History Center

"Russia right now is a world leader in unexploited mathematical/logical talent and creativity. Its programmers are beginning to recognize their own capabilities, and they will no doubt figure out how to organize their marketplace better, putting in place not just software firms but training centers, educational loans, and the like. I expect them to be recognized as leaders not so much for financial muscle, but as the community to go to when you want creative solutions to tough programming problems. The Russian talent for algorithms will shine."

"As long as there is business opportunity – and I am confident there will be – the US will provide world leadership in software development."

BACKGROUND

In the world of software development, a handful of hot spots have been glowing over the last decade. India, which sold $6.2 billion worth of software in 2001, is catching up with Japan, which drew revenues of $14.9 billion. With heft like that, these powerhouses – chasing the US, whose sales hit $96.6 billion – look like long-term contenders. But nothing is permanent, right? Israel ($607 million in 2001 sales), Russia ($431 million), and Ireland ($405 million) are throwing off sparks, and Dyson believes this is just the beginning.

PHOTOGRAPH LEFT: JASON GROW/CORBIS SABA

Weblogs will outrank the *New York Times* Web site by 2007 (based on a Google search of five keywords or phrases reflecting the top five news stories).

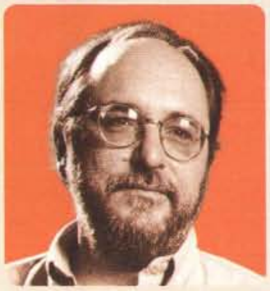
YES

Dave Winer

CEO, Userland.com

DESIGNATED NONPROFIT:

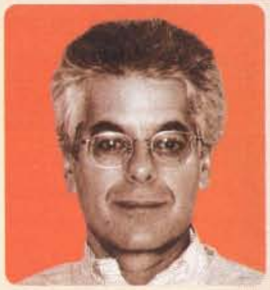
World Wide Web Consortium



THE STAKE

$1,000

NO



Martin Nisenholtz

CEO, New York Times Digital

DESIGNATED NONPROFIT:

Neediest Cases Fund

"We're returning to what I call amateur journalism: created for the love of writing, without expectation of financial compensation. This process is fed by the changing economics of the publishing industry, which is employing fewer writers and editors. The Web has taught us to expect more information, not less, and that's the sea change the *Times* faces: how to remain relevant to a population that can do for themselves what the big publications won't. The "dumb it down" philosophy forces all stories through too narrow a channel to serve the diverse world we live in. When the *Times* covers my industry, for instance, it seems to know three stories – Microsoft is evil, Java (or whatever the topic du jour) is the future, and Apple is dead. All other stories are cast as one of those three. Bored readers are looking for alternatives, but because the paper is limited in its number of writers, it can't branch out to cover other angles. My bet says the tide has turned: Informed people will look to amateurs they trust for information they want."

"Readers need a source of information that is unbiased, accurate, and coherent. News organizations like the *Times* can provide that far more consistently than private parties can. Besides, the weblog phenomenon does not represent anything fundamentally new in the news media: *The New York Times* has been publishing individual points of view on the Op Ed page for 100 years. In any case, *nytimes.com* and weblogs are not mutually exclusive. We would like to extend our ability to act as a host for all sorts of opinions, and weblog technology might well be useful in doing so. After all, in countries whose citizens don't enjoy First Amendment protection, weblogs are run by people who'd be considered professional journalists in the US. In its six years online, *nytimes.com* has been a center of innovation, and it'll continue to be, incorporating weblogs and whatever else will enable our reporters and editors to present authoritative coverage of the most important events of the day, immediately and accurately."

BACKGROUND

Over nearly two centuries, the bastions of traditional news journalism have built an imposing standard of reporting and presentation. About a decade ago, these news outlets began posting their work online. In the meantime, the advent of weblogs allowed individuals to, in effect, publish their own journalism. The first such sites – essentially electronic diaries to which readers could add their comments – appeared in the mid-'90s; the current tally may well be in the hundreds of thousands. While they don't always hew to traditional news values of accuracy and objectivity, blogs do at their best convey an authenticity and immediacy the big outlets can't summon.

For this bet, five searches on Google (which ranks a page's relevance by the number of other URLs that link to it) will determine the outcome. If a blog outranks *nytimes.com* in three or more searches, Winer prevails. If not, the victory goes to Nisenholtz. And what happens if news organizations appropriate the emergent format to bolster their own authority? If *The New York Times* runs a blog that tops a Google search by 2007, Nisenholtz claims the triumph.

PHOTOGRAPHS FROM LEFT: KAI WEICHMANN; ALEX FREUND

The US men's soccer team will win the World Cup before the Red Sox win the World Series.

YES

Mike Elliott

Editor at large, *Time*

DESIGNATED NONPROFIT:

Vaccine Fund of the Global Alliance for Vaccines and Immunization

THE STAKE

$1,000

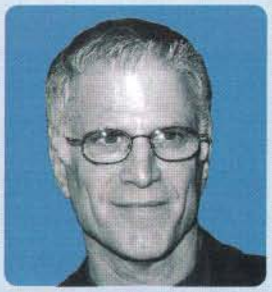
NO

Ted Danson

Actor

DESIGNATED NONPROFIT:

American Oceans Campaign



"As immigration and technology continue to make the US a more international nation, so the quality of its soccer team will continue to rise. Already, American teenagers can hold their own with players from more established countries, while players like Claudio Reyna and Kasey Keller have become acknowledged international stars. The Curse of the Bambino, on the other hand, is one of those mystical truths beyond the reach of human intervention. Cheers, Ted."

"The Red Sox have had such bad luck in the 20th century, I have to believe that in the new millennium it can only get better. Besides, statistically, scoring goals is harder than hitting a home run, and in the World Cup, you have the whole world against you. The Red Sox only have to beat the Yankees."

BACKGROUND

As the one-world culture of the 21st century reaches into every corner of our lives, sports is no exception. And for a country as economically, intellectually, and culturally global as the United States, international "football" mania is nothing less than inevitable. FIFA, the foremost international soccer authority, estimates that today there are 18 million soccer players in the US - giving the nation one of the highest proportions of players worldwide. Nevertheless, the US men's team has yet to advance beyond the second round in the World Cup. If the United States dominates the shrinking globe in finance, defense, film, computing - why not soccer? Perhaps because popularity doesn't actually score you points on the field. Ask a diehard Red Sox fan - the beloved but beleaguered BoSox haven't won a World Series since 1918.

PHOTOGRAPHS FROM LEFT: COURTESY *TIME* MAGAZINE; VINCE BUCCI/GETTY IMAGES

Open Bets

THERE'S NO END to the number of predictions we might make about the future, but *bets* are a different story. A bet requires an opponent. Of course, if no one chooses to contest a forecast (Internet security breaches will increase over the next three years – any takers?), you've learned how much certainty a proposition inspires. On the other hand, you might find a rash of challengers (Al Gore will win the presidency in 2004), in which case, you've learned something else. These three bets are among those awaiting their matches at *www.longbets.org*. Will anyone risk $1,000?

"Wanna Bet?" writing and reporting contributed by Martha Baer, Chris Baker, Alix Berger, Ted Greenwald, and Jenn Kahn.

***Look for more Long Bets – and reports on their outcomes – in subsequent issues of* Wired.**

THE END OF "EVERYTHING"

Neither superstring theory, membrane theory, nor any other unified theory describing all the forces of nature will have won a Nobel Prize by 2020.

John Horgan

Author, *The End of Science* and *The Undiscovered Mind*
DESIGNATED NONPROFIT:
Nature Conservancy

THE STAKE: $1,000

"The dream of a unified theory, a theory of everything, will never be entirely abandoned. But I predict that, over the next 20 years, fewer smart young physicists will be attracted to an endeavor that has vanishingly little hope of an empirical payoff. Most physicists will come to accept that nature might not share our passion for unity. Physicists have already produced theories – Newtonian mechanics, quantum mechanics, general relativity, nonlinear dynamics – that work extraordinarily well in certain domains, and there is no reason why there should be a single theory that applies to everything. The quest for a unified theory will come to be seen not as a branch of science, which tells us about the real world, but as a kind of mathematical theology."

BACKGROUND

There were two great insights in the 20th century about how our universe works. One was Einstein's theory of relativity and the other was quantum physics. Both of these breakthroughs can successfully predict events in their own respective realms (gravitational fields versus electromagnetism and subatomic interactions), but their findings cannot be reconciled with each other. Scientists have struggled to develop a unified theory that can accommodate the seeming contradictions between the two. Stephen Hawking famously termed it the Grand Unification Theory and suggested that its discovery is tantamount to "reading the mind of God." Many feel that promising advances have been made along the lines of superstring theory, which posits a 10-dimensional universe in which the presence of vibrating strings or membranes account for the inexplicable behavior of subatomic particles. Noted contrarian John Horgan is characteristically skeptical of this research, chalking it up to nothing more than a desperate need for order among scientists.

PHOTOGRAPH: ALEX FREUND

Bioterror, or bioerror, will lead to 1 million casualties in a single event by 2020.

Martin Rees

Astrophysicist, Institute for Advanced Study, Princeton

DESIGNATED NONPROFIT:

King's College Chapel Foundation

THE STAKE: $1,000

"Biotechnology is advancing rapidly, and by 2020 there will be thousands – even millions – of people with the capability to cause a catastrophic biological disaster. My concern is not only organized terrorist groups but individual weirdos with the mindset of people who now design computer viruses. Even if all nations impose effective regulations on potentially dangerous technologies, the chance of active enforcement seems to me as small as in the case of the drug laws."

BACKGROUND

Biological warfare dates back to at least 1763, when British general Jeffery Amherst ordered that the blankets of smallpox patients be given to Delaware Indians. Such practices were outlawed – along with chemical weapons – by the 1925 Geneva Convention, after chlorine and mustard gas attacks caused 1.2 million casualties in World War I. Even research into biowarfare was prohibited by the 1972 Biological Weapons Convention. Since then, we've suffered practically no incidents involving either chemical or biological weaponry in conventional warfare. At the dawn of the 21st century, however, conventional war is hardly the only threat. The 1995 sarin gas attack on the Tokyo subway (total fatalities: 15) and last year's anthrax mail attack (total fatalities: 5) prove that even a small-scale disaster by a few fringe figures can provoke worldwide fear. And these events only hint at the potential nightmare of a large-scale bioterrorist assault. Justifiably, the UN classifies chemical and biological weapons as "weapons of mass destruction" alongside nuclear warheads, and while existing toxins like anthrax, botulism, pneumonic plague, cholera, diphtheria, and Ebola are terrifying enough, our advancing understanding of biology could yield still more horrors. Rees is willing to bet that an unprecedented biological disaster will occur within two decades.

At least one human born in the year 2000 will still be alive in 2150.

Peter Schwartz

Cofounder and chair, Global Business Network; author, *The Art of the Long View*

DESIGNATED NONPROFIT:

Chabot Space & Science Center

THE STAKE: $1,000

"Science and medicine will not only extend more people's lives to their full Hayflick span, 120 years, but advances in biology will lengthen human life even beyond that. If we look at the current work on stem cells and phenomena like telomerase, an enzyme in DNA, we find we're learning a great deal about the control mechanisms for aging. It's very likely that over the next 25 years, society will see serious and effective medical intervention in the aging process – people undergoing such therapy will keep looking and feeling and acting younger than their calendar age. The prospect of individuals living significantly longer than the current norm will begin to open up. In fact, looking at historical trends, one finds that over the past century, we nearly doubled our lifespan, the average having gone from about 45 to 85. There's no reason to imagine that we won't do at least as much in the next century. If you double 85, you're at 170 – so my bet is actually conservative."

BACKGROUND

On August 4, 1997, Jeanne Louise Calment of Arles, France, died at the age of 122 years and 164 days. Hers was the longest human life on record, and it added ballast to a proposition, labeled the "Hayflick limit," posited by biologist Leonard Hayflick in 1961. By growing human embryonic lines in a lab, Hayflick demonstrated that cells divide only about 50 times before entering senescence, at which point they become inert and begin degenerating, making their human hosts prone to ailments like liver disease and arteriosclerosis. The Hayflick limit ordains that even if you avoid serious injury and illness, your "molecular clock" will wind down and your cells cease dividing. But don't stop feeding your 401(k). Schwartz says the Hayflick limit is reaching a limit.

PHOTOGRAPHS FROM LEFT: COURTESY NEWCASTLE UNIVERSITY; GARY LAUFMAN

The LIST

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American Honda Motor Co., Inc.	(800) 33 honda
Anthro Corp	(800) 325 3841
Apple	
Audi of America, Inc.	(800) FOR AUDI
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BMW	(800) 334 4BMW
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CDW Computer Centers, Inc.	(888) 239 7315
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Hitachi America, Ltd.	(800) HITACHI
Hummer	(800) REAL 4WD
IBM e-infrastructure	
Interland	(800) 338 8276
Investec	(800) 915 6565 x.850
Lexus	(800) USA LEXUS
Maker's Mark Distillery, Inc.	
Memorex	(562) 906 2800
Microsoft	
MINI, a division of BMW, LLC.	
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New Mexico Department of Tourism	(800) 733 6396 x.2026
Platinum Guild International	
Rackspace Managed Hosting	(800) 961 2888
Sharp Corporation	(800) BE SHARP
Subaru	(800) WANT AWD
Toyota Motor Sales	(800) GO TOYOTA
Virgin Atlantic Airways	(800) 862 8621
Volkswagen of America, Inc.	(800) DRIVE VW
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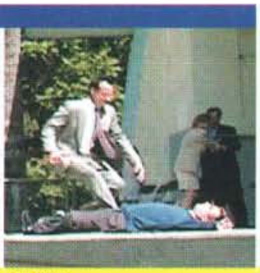


MOVIE

Nothing So Strange

$9 PLUS POPCORN

Bang. It's December 2, 1999, and Bill Gates is assassinated by an unknown gunman in LA's MacArthur Park. In the crime's wake, the conspiracy group Citizens for Truth rises up to uncover the killer. This is the premise of Brian Flemming's digital spoof, *Nothing So Strange*.

Bill Gates is dead. What now?

To maintain the 90-minute mockumentary's sense of realism, Flemming filmed his actors at actual events, such as the 2000 Democratic National Convention. He also produced a ring of phony Web sites. Check out the DA's findings (*www.garcettireport.org*) and Jack Perdue's Billgatesisdead.com portal.

Even if you think you can't bear to imagine a world without Chairman Bill, see this film. At its best, *Nothing So Strange* is a hilarious parody of social activism's pitfalls. It's hard not to laugh as the nonexistent Citizens for Truth earnestly votes on whether to make decisions based on consensus or majority rule. – *Jennie Rose*

See *www.nothingsostrange.com* for festival dates.

EXHIBITION

Game On: The Culture and History of Videogames

$16

Behold! The largest, most comprehensive collection of computer and videogame memorabilia ever assembled is about to go on display. *Game On*, opening at the Barbican Gallery in London in May (and traveling to the US in 2003), chronicles 40 years of game development.

The show is every player's dream. View more than 250 separate exhibits, including hard-to-find vintage titles. In a wonderful coup, organizers nabbed one of only 10 or so known working DEC PDP-1 minicomputers, which runs Steve Russell's legendary *Space War!* (1962), the first computer game ever. From there, you can move through old arcade favorites – *Computer Space* (1971), *Pong* (1972), *Space Invaders* (1978), and *Pac-Man* (1980) – and on to the Atari 2600 (1977) and Magnavox Odyssey (1972) consoles. Of course, the 21st-century Xbox, GameCube, and PS2 are represented, too.

Fifty play stations. Zero quarters required.

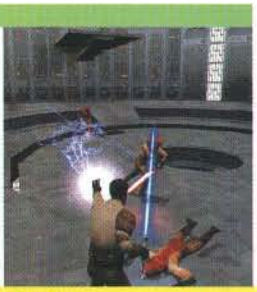
There's more than hardware to lust after here. As curator Lucien King says, "Our broad aim is to explore the culture, history, and global context of the industry." The exhibition and accompanying book, *Game On* ($28, from Laurence King), deconstruct characters (like Lara Croft) along gender and age lines and examine their relationships with players. They also consider the various sociological contexts of releases from Japan, the US, and the rest of the world.

Game On offers case studies of specific titles (*Pokémon* and *The Sims* among them) that demystify just how games are made. It's not about a single creative genius working alone in some back room anymore. Games come from the collective imagination of large development teams. This idea, it turns out, parallels the evolution of the way we play games. What began as heroic individualism – solitary epics of self-expression – is increasingly about interaction among many participants.

The show also delves into the complex relationship between the gaming community and Hollywood. Comparing film posters, screenings, and playable versions of franchises like James Bond and *Final Fantasy*, it becomes clear that what makes a good game doesn't always make a good film and vice versa (think *Tomb Raider*).

Game On ultimately reminds us that games are part of a living culture. By making the works available to the public in an art gallery instead of a commercial environment, King hopes to invite a fresh, more critical appraisal. Who are they kidding? Fifty game stations. Zero quarters required. I'm there. – *Matthew Stibbe*

May 16 through September 15 at the Barbican Gallery, London: *www.barbican.org.uk*. Check *www.gameonweb.co.uk* for US venues. Laurence King: *www.laurence-king.com*.



GAME

Star Wars Jedi Knight II: Jedi Outcast

$50

Step into the Jedi boots of Kyle Katarn and explore eight *Star Wars* locales in this PC adventure set nine years after *Return of the Jedi*. The Empire has been defeated, but all is not well in the galaxy. It's up to you to take out the evil clan before it reclaims power.

Eradicate evil in 3-D

Though this is the third installment in a series, *Jedi Outcast*'s original story line and 3-D action – powered by the *Quake III: Arena* engine – keep the game exciting. Battle squads of stormtroopers with the 14 weapons at your disposal, including the Wookiee bowcaster, the stun baton, and, of course, the deadly and perpetually cool lightsaber. Beyond hardware, invoke one of your Force powers to confuse, choke, or push your enemy without lifting a finger.

When single-player mode gets too easy, try the multiplayer experience and become Luke Skywalker or Lando Calrissian. It doesn't disappoint. – *John Gaudiosi*

LucasArts Entertainment: *www.lucasarts.com*.

MOVIE

Dogtown and Z-Boys

$9 PLUS POPCORN

The "debris meets the sea" in Dogtown – a no-man's land between Santa Monica and Venice Beach, California. In this dreary stretch of urban decay, a crew of street urchins revolutionized the skateboarding industry in the 1970s. The life and times of 11 early adopters is the energetic and supercilious focus of the documentary *Dogtown and Z-Boys*.

In the beginning, skateboarders were seldom seen as anything more than surfers doing wheelies. But the scene changed after a Jeff Ho & Zephyr Production Surf Shop, a Dogtown hangout, sponsored the tight-knit group of renegades who'd grown up in broken homes and skated on the run. They had raw genius and a low-center-of-gravity style only desperation and desolation could inspire. Dubbed the Zephyr Skating Team (Z-Boys for short), they made their first big public appearance at the 1975 Del Mar Nationals. The Z-Boys took the competition by storm, redefining the sport and transforming themselves into magazine-cover star athletes.

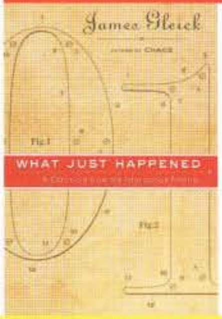
The street urchins who revolutionized skateboarding

But fame begat big egos and larger paychecks that quickly collapsed the Dogtown gang. Filmmaker and former Z-Boy Stacy Peralta documents their varying life trajectories. We see Tony Alva running his own skateboard company, while Jay Adams – one of the most talented of the bunch – gets caught up in booze and drugs.

Told through the entertaining bluster of its players – who clearly rejoice in reliving their glory dates – *Dogtown* is as wild a ride as a fingerflip airwalk. It's no surprise Peralta won the 2001 Sundance Film Festival director's and audience awards. He takes full advantage of the unfettered trust of his former teammates (save for one that was mysteriously "last seen in Mexico") and brings the old 8-mm reels and photos alive with inventive camera work, a score packed with '70s superjams, and narration by Sean Penn.

On a grander scale, *Dogtown* is a snapshot of how mass marketing can compromise sports. Skating has succumbed to sponsorships, television ads, and videogames. But Peralta makes it clear that the Z-Boys provided the spiritual fire behind the gold-plated success of American snowboarders. – *Tank Menzies*

In theaters April 26 from Sony Pictures Classics: *www.sonyclassics.com*.



BOOK

What Just Happened: A Chronicle From the Information Frontier, by James Gleick

$24

Looking for clues about life after Enron? 9/11? Maybe Webvan? You won't find them here. Sure, James Gleick built his rep by wrestling with complexity: His book *Chaos* made the world safe for the new science of disorder. *Genius* laid bare the artistry at the heart of the Manhattan Project. *Faster* freeze-framed Internet time. But apparently the roaring '90s proved more elusive than the Bomb or Bengali typhoons, so *What Just Happened* won't launch a new understanding of network effects. Instead, this collection of previously published essays provides a time tunnel – part pause for reflection, part greatest hits.

Time tunneling through the '90

Spanning August 1992 to April 2001, Gleick's book details a decade's obsessions, with lucid reporting and a deft human touch. His 1995 anatomy of the Microsoft monopoly is technically astute and remarkably ahead of the curve. Satiric shorts like "Click OK to Agree" quickly find their mark and neatly skewer the shape of things to come. Unfortunately, as Gleick observes, the present has a way of staying with us. The closing chapters are the only two guilty of relevance; the early dispatches from the electronic wilderness now read like James Fenimore Cooper.

So, why take this stroll through the digital attic? Gleick quotes Stewart Brand: "There has never been a time of such drastic and irretrievable information loss. . . . We do short-term memory, period." A succinct argument for an information age diary. But what *Just Happened* really chronicles is the evolution of Gleick's voice. "It's a frontier," he writes of the Net in 1994, "befitting its origins: unruly, impolite, and anarchic. But also democratic." By '96, it's a "sales bazaar as scummy and senseless as any on the face of the planet." Come spring 2000, he's morphed from consumer-netizen into a cognitive dissident lamenting that the catalyst for creativity has become a carburetor for corporate power. At finish, Gleick's biggest mistake is his refusal to let go. The Revolution™ has been commoditized. Where do you want to go today? – *William O. Goggins*

Pantheon: *www.pantheonbooks.com*.

IMAGE CENTER: GLEN E. FRIEDMAN

WEB

Rustboy.com

FREE

One-man CG show

Two years ago, Scottish graphic designer Brian Taylor set out to prove that he could make a killer CG flick with few resources and ample determination. With an outdated G4, discontinued software, and some talent, he began working on *Rustboy* – a Tim Burton-esque tale of a tin boy who comes to life when he's struck by lightning.

Chart Taylor's progress at Rustboy.com, an exhaustive online documentation of the production. The site contains weekly updates, concept art, streaming video, and a making-of section that serves as an animation primer. Especially groovy is the intro sequence clip, which features a Danny Elfman-like score by New Yorker Erik Nickerson and helps to illustrate Taylor's digital layering technique.

The grassroots effort has drawn praise – and casual job offers – from the big kids at Pixar and Lucasfilm. But Taylor has turned them down. Their interest in his very low-budget work simply proves his point. – *Tank Menzies*

Rustboy.com: *www.rustboy.com.*

DVD

Jin-Roh: The Wolf Brigade – Special Edition

$60

Known for its hyperkinetic energy and hardware fetishism, anime makes Hollywood's action blockbusters seem positively tame. But the genre is showing signs of maturing beyond sci-fi thrills and clashing ninjas. Case in point: *Jin-Roh* (man-wolf in Japanese) adds a dose of human drama to classic anime elements. The result is a film that skillfully juggles explosions and emotions.

Jin-Roh is set in a world in which the Nazis won WWII. A decade after the war, the government and its Capital Police are fighting an underground resistance group called the Sect. The establishment is also threatened from within as a rogue police unit conspires to win power. Against this backdrop, *Jin-Roh* follows the doomed relationship between Fuse, a disgraced special-forces soldier, and Kei, the look-alike of a terrorist bomber Fuse failed to kill.

Megaviolent manga retooled as a love story

The movie's dynamic thrust results from the collaboration of two filmmakers from different generations. In the DVD's extensive interviews, we learn that Mamoru Oshii, veteran director of such landmarks as *Ghost in the Shell* and the *Patlabor* series, approached newcomer Hiroyuki Okiura to adapt his manga *Hellhounds: Panzer Corps* into a movie. Okiura, who had worked as an animation supervisor on *Ghost*, agreed, with one condition: The megaviolent material had to be retooled as a love story.

Thus Oshii's comic became a nightmarish fable of wolf-soldiers who aren't able to live and find love among humans. Yet unlike his comrades, Fuse feels anxious in his commando role. With piercing infrared goggles he looks every bit the wolf. But his inability to act calls his inner animal into question.

Beyond the plotlines, the story is told through visuals. The animation's meticulously drawn, verité style and subdued color palette imbue the movie with an old newsreel feel that realistically conveys the dreary post-WWII atmosphere. The German occupation is subtly reflected in the VWs, Sten guns, and Lugers in the DVD's production sketches, while the sweeping score performed by the Czech Philharmonic Orchestra lends rich, haunting dimension. Although the DVD features the usual array of dubbed and subbed audio options, the Japanese-language DTS track is so exquisitely detailed, you'll hear the spent cartridges pinging off your living room walls.

Jin-Roh is also punctuated by readings from *Rotkäppchen*, the Grimm brothers' more sinister retelling of *Little Red Riding Hood*. This clever narrative touch fits perfectly in *Jin-Roh*'s bleak and ruthless world. – *Scott Taves*

Bandai Entertainment: *www.bandai-ent.com.*

README

ON THE BOOKSHELVES OF THE DIGERATI

Christiane Paul
Adjunct curator of new media arts, Whitney Museum of American Art

***Beyond Webcams: An Introduction to Online Robots*, edited by Ken Goldberg and Roland Siegwart (2001)**

"This is a very hands-on case study by 18 research teams reporting on their specific telerobotic environments. It includes the Jason robot that explored the *Titanic*, the autonomous mobile robot Xavier at Carnegie Mellon, and a robot that paints. The book gets very technical, with diagrams and teleprogramming scripts, but kept me interested. Even though there are no telerobotic works in this year's *Biennial*, for me as a curator, it's very important to have a profound understanding of the medium and how artists are using it."

Jim Blinn
Microsoft research fellow

***The Skeptical Environmentalist: Measuring the Real State of the World*, by Bjørn Lomborg (2001)**

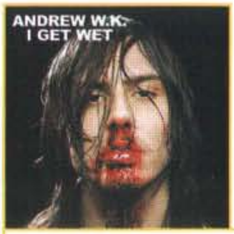
"This is one of those 'everything you know is wrong' books. The author closely examines real environmental data and draws rather different conclusions from what is commonly expected. Typically, the environmental movement concentrates on how bad things are, and how drastically they're getting worse. Lomborg, however, found that things are getting better. But he doesn't suggest that we can all relax and not worry about the environment. He thinks that we should have a much more realistic idea of exactly what the situation is, and in what direction it's moving. It's pretty well accepted that quoting numbers makes you sound more erudite, but it doesn't make what you say true."

MUSIC

Natalie Imbruglia

White Lilies Island [RCA]

Four years have passed since Natalie Imbruglia ripped up the pop charts with "Torn," but the Aussie actor turned songwriter hasn't lost any steam. She belts out the opener here with the same sense of urgency, then moves on to an assortment of **guitar-fired rockers and sweet ballads**. God only knows why RCA chose "Wrong Impression" – the least original four minutes on the CD (ever heard the Sundays?) – as the first US single when it had so many other contenders. Though none screams instant hit, after a few spins, "That Day," "Hurricane," and "Sunlight" will be stuck in your head. – *Rebecca Smith Hurd*



Andrew W.K.

I Get Wet [ISLAND]

Imagine the hesher from your high school tweaking on amphetamines and making a kegger record, and you come close to Andrew W.K.'s aesthetic. *I Get Wet* is a pop-metal frenzy, a collection of tunes about **partying till you puke** that attacks a good time like a special unit of the maniacal armed forces. Just when you thought the feel-good anthems of Twisted Sister and Quiet Riot had vanished, A.W.K. drops a happy reminder that the old Crüe's mantras are still relevant. – *Jennifer Maerz*

Jazzanova

In Between [JCR]

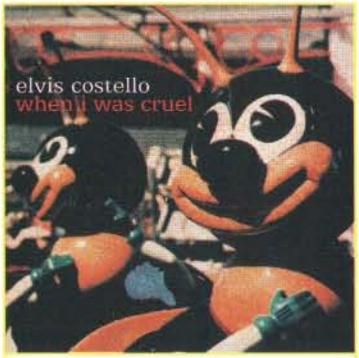
On its debut album, German beat-builder Jazzanova matriculates from the intensity of its past singles toward more reflective electronic jazz. "Mwela, Mwela" is symbolic of the journey: An **emphatic techno mosaic** blooms into a sanguine soul-drenched vocal track without losing any of its youthful impulse. Some of the songs' transient tendencies are countered by the group's sophisticated programming, which gives the music a deceptively organic and wholly inventive feel. – *Joseph Patel*

Knoc-Turn'Al

Knoc's Landin'

[LA CONFIDENTIAL/ELEKTRA]

When it comes to production, Dr. Dre can make even an accordion sound hot – and he does in "The Knoc," the first single from a fresh G-funker **bred in the fertile rap sands** of Long Beach, California. With Dre and Missy Elliott as guests, "The Knoc" has enough star power to ensure ubiquitous video and radio play. But it takes a dexterous rapper to keep the best beats credible. Knoc's flow is sharp enough to navigate the rhythmic twists that unfold here. The priceless moment in this solid debut comes when Knoc duets with the oversexed Too $hort on "Cash Sniffin' Noses," basically "California Girls" in the 'hood. – *Tamara Palmer*



Elvis Costello

When I Was Cruel [ISLAND]

Fans may have grown impatient with Costello's far-flung musical forays, but crooning with Burt Bacharach and playing classical with Anne Sofie von Otter clearly recharged him. These 15 vivid songs drip with the kind of caustic lyrics and melodies that made Costello a star. *Cruel* is chock-full of **rowdy horns and provocative wordplay**. "Alibi" – a musical cousin to the classic "Alison" – nails the emotional excuses we hide behind ("Sorry but your mommy doesn't love you, Alibi"). And the moody title tune has a man looking back on his callous youth. Who else could make a lyric like "humdrum conundrum" sound so beautiful? – *Beth Johnson*

Arturo Sandoval

My Passion for the Piano

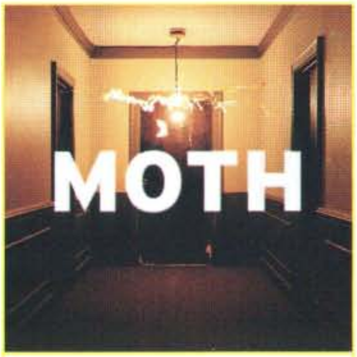
[CRESCENT MOON/COLUMBIA]

Cuban-born Arturo Sandoval has already made his mark as a fiery trumpeter. He's also a gifted jazz pianist, and with this record, he's finally showcasing that talent. Working in a trio setting, Sandoval's **keyboard agility** takes center stage. His flair for pursuing an intricate thematic improvisation is brought into focus on "Sureña." His original composition, "Blues en Fa," is animated by a delightful sense of swing. – *Philip Van Vleck*

Angélique Kidjo

Black Ivory Soul [COLUMBIA]

Angélique Kidjo draws inspiration from the Brazilian people of Benin, West Africa, on this, her seventh release. Recorded with African and Brazilian studio musicians, *Black Ivory Soul* **simmers with sensuality**, from the sultry dance rhythms of "Tumba" and the exuberance of "Afrika" to the supple beats of the title song and "Lemanja." After heating things nearly to the boiling point, Kidjo cools it down, closing with a heartfelt rendition of Serge Gainsbourg's "Ces Petits Riens." – *Chris Rubin*



Moth

Provisions, Fiction, and Gear

[VIRGIN]

Unlike Mother Nature's airborne annoyances, these garage heroes from Cincinnati will make your heart flutter. On its first major-label release, Moth covers the bases, from playful punk – "I See Sound," its first single – to wistful tunes like "Not Really." Some credit for the disc's **raw energy and fearless ax-handling** goes to producer Sean Beavan, who made his name working with Marilyn Manson and Nine Inch Nails. Serving up an infectious set ideal for cranking on the car stereo, the ensemble might join the geek-chic ranks of Weezer and the Foo Fighters. This Moth infestation is welcome in any house. – *Ellen Lieberman*

SOFTWARE/HARDWARE

Pro Tools Mbox

$495

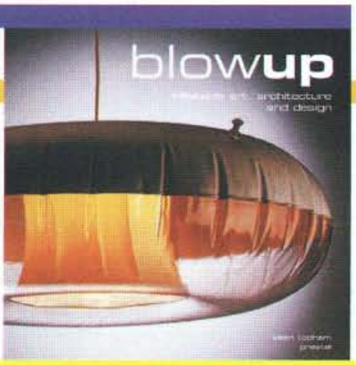
Pro Tools is the undisputed badass of digital audio recording. But the high-end system's price tag has kept it out of reach of most hobbyists – until now. Digidesign has answered the call for cheap, portable, yet totally stable production with the Mbox.

Record digital audio on the fly

The 24-ounce unit's backside is fitted with multiple ins and outs, including Focusrite's dual mike preamp inputs. This expands a producer's ability to instantly track and record any sound, yet still achieve pristine clarity. The front of the paperback-sized unit has dedicated controls for hands-on volume tweaking. And, in true plug-and-play fashion, everything is powered by your Mac's existing USB hub. A PC version is coming soon.

Perhaps best of all, the Mbox ships with the latest Pro Tools LE software, version 5.2. The app's editing and mixing capabilities are unparalleled, and its new DigiStudio compatibility opens up the world of online collaboration. – *Jason Edwards*

Digidesign:
www.digidesign.com.



BOOK

Blow-Up: Inflatable Art, Architecture, and Design, by Sean Topham

$30

"Most inflatable design is rubbish," proclaims Sean Topham in the first line of his new book, *Blow-Up*. He then spends the next 160 pages celebrating a delightful gamut of exceptions and their social significance. Touching on radical politics, the Goodyear blimp, and kinky sex, Topham suggests that pneumatic objects serve as symbols of technological utopianism, escape, and, well, fun.

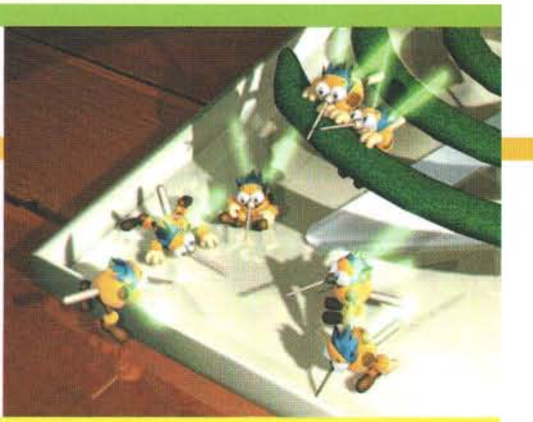
Like the random path of a balloon aloft, the author drifts from subject to subject. From the Montgolfier brothers' hot air balloon flights in the 1780s (they launched a sheep, a duck, and a rooster before King Louis XVI and 120,000 onlookers in France) to the inflatable decoy planes of World War II, Topham segues effortlessly between tales. This playfully wide purview suggests how PVC is culturally meaningful.

Historical detail bolsters the stream-of-consciousness writing style. Take, for example, Topham's pages on the evolution of disposable and inexpensive inflatable architecture. It was first conceived of in the 1960s as a rebellious alternative to the rigid, boxlike designs of modernist masters like Mies van der Rohe and Le Corbusier. To prove his point, Topham recalls the work of daring young collectives such as Britain's Archigram. Archigram designed funky, soft, portable, and colorful air-filled plastic buildings and furniture that threatened to make citizens reject hard-edged walls, ceilings, and floors. He likens Archigram's idealistic and mass-market attitude to that of the pop artists (every pun intended, surely). Andy Warhol, as Topham reminds us, released helium-filled Mylar pillows over Manhattan. "The act of allowing the sculpture to escape from the confines of the gallery space," he writes, "can be viewed as an attack on art galleries which were, and still are, regarded as elitist institutions."

The pneumatics of politics, kinky sex, and the Goodyear blimp

Despite his grand proclamations on the ongoing influence of the medium, Topham's book is grounded by skepticism. He's careful to point out the failures of overly ambitious designers seduced by turgid forms. Remember the *Hindenburg*? – *Reena Jana*

Prestel: *www.prestel-usa.com.*



GAME

Mister Mosquito

$50

Ka: Yamada-Ke No Natsu is the sort of innovative yet bizarre Japanese videogame that usually doesn't make it to the US. Lucky for us, this PS2 adventure is here – under the name *Mister Mosquito* – courtesy of Eidos Interactive's new import boutique, Fresh Games.

In this bloodsucker, you play the simultaneously adorable and ghoulish mosquito who moves in with the Yamada family – schoolgirl Reina (type B positive), harried housewife Mom (AB positive), and nerdy salesman Dad (O positive). From your bug's-eye view, their modest home offers vistas of mountainous furniture, appliances as big as SUVs, and a bountiful food supply.

America's new blood sport

Your goal, of course, is to prey upon the Yamadas, zeroing in on their Suck Points and filling up on their plasma. The feeding process is laden with innuendo: After you stab into unprotected flesh with your proboscis, blood sucking requires a rhythmic, circular motion of the joystick. The wacky game is also as voyeuristic as it is unwholesome. Watch Reina soak in the tub! Watch Dad watch TV in his underwear!

Like a clan of Godzillas, the Yamadas tower above you – and they're just as dangerous when riled. The family becomes increasingly frazzled as Mister Mosquito settles in for a long stay. They'll attack you with repellents, insecticide, and their bare hands. But like an expert acupuncturist, you can poke the Yamadas on their Relax Points so they'll chill out – at least for a while. – *Chris Baker*

Eidos: *www.eidos.com.*

SOFTWARE

StreamSage

FREE

Few things are so humbling as being unable to participate in watercooler talk – as happened to me when the topic turned to the latest wrinkle in the Enron scandal. I didn't stay out of the loop for long, though. I retrieved a quote in minutes on National Public Radio's Web site (*www.npr.com*), the first equipped with StreamSage's extensive search engine, which can locate not just text but digital audio or video clips in no time flat.

Find video and sound bytes fast

Part indexer (it parses media into topical segments), part query server (users search the cataloged information), StreamSage 1.0 creates a ranked list based on the keywords you input. Now you can track down talking points before heading to that dinner party. – *Vincent Jones*

StreamSage: *www.streamsage.com.*

SMALL PIECES LOOSELY JOINED
{a unified theory of the web}
DAVID WEINBERGER
co-author of the cluetrain manifesto

BOOK

Small Pieces Loosely Joined: A Unified Theory of the Web, by David Weinberger

$25

The next time someone tells you that the Internet revolution failed – as evidenced by all of those dotcom busts – hand them a copy of *Small Pieces Loosely Joined*. Written by the brain behind *The Cluetrain Manifesto*, this backlash against the Internet backlash argues that the Net's underlying technical philosophy has forever permeated our society and our psyche. The Net has so completely remade our world, writes author David Weinberger, that many of us have a hard time remembering what things were like before it existed.

Of course, if you already think in HTML and surf the Web in bed with your wireless laptop, few of his musings will seem tremendously earth-shattering. Take Weinberger on the Internet's lack of quality control: "The open architecture of the Web guarantees that it will always present bad information." He couldn't have said it better in 1995.

Those with one foot in the future and one in the past, however, are sure to be entertained by Weinberger's well-written observations about the curiosities of our age. For example, corporate Web sites look like a weird cross between a magazine ad and a catalog. Nevertheless, writes Weinberger, "Vandalizing *www.nike.com* is more like vandalizing the Nike building than its marketing literature."

A never-say-die account of the Net revolution

This book's biggest failing is that it ignores the real factors that might stamp out the Net revolution – lawsuit-happy lawyers, for instance, who have been largely successful at shutting down fan sites and all those online databases of copyrighted lyrics. What's more, using dead trees to distribute thoughts about the information superhighway is an ironic twist that never gets addressed. And although Weinberger contends that "the Web has not been hyped enough," the crucial issue isn't whether it will still be there tomorrow, but whether it will be made up of individual voices or controlled by corporate megaliths. – *Simson Garfinkel*

Perseus Publishing: *www.perseuspublishing.com.*

Contributors

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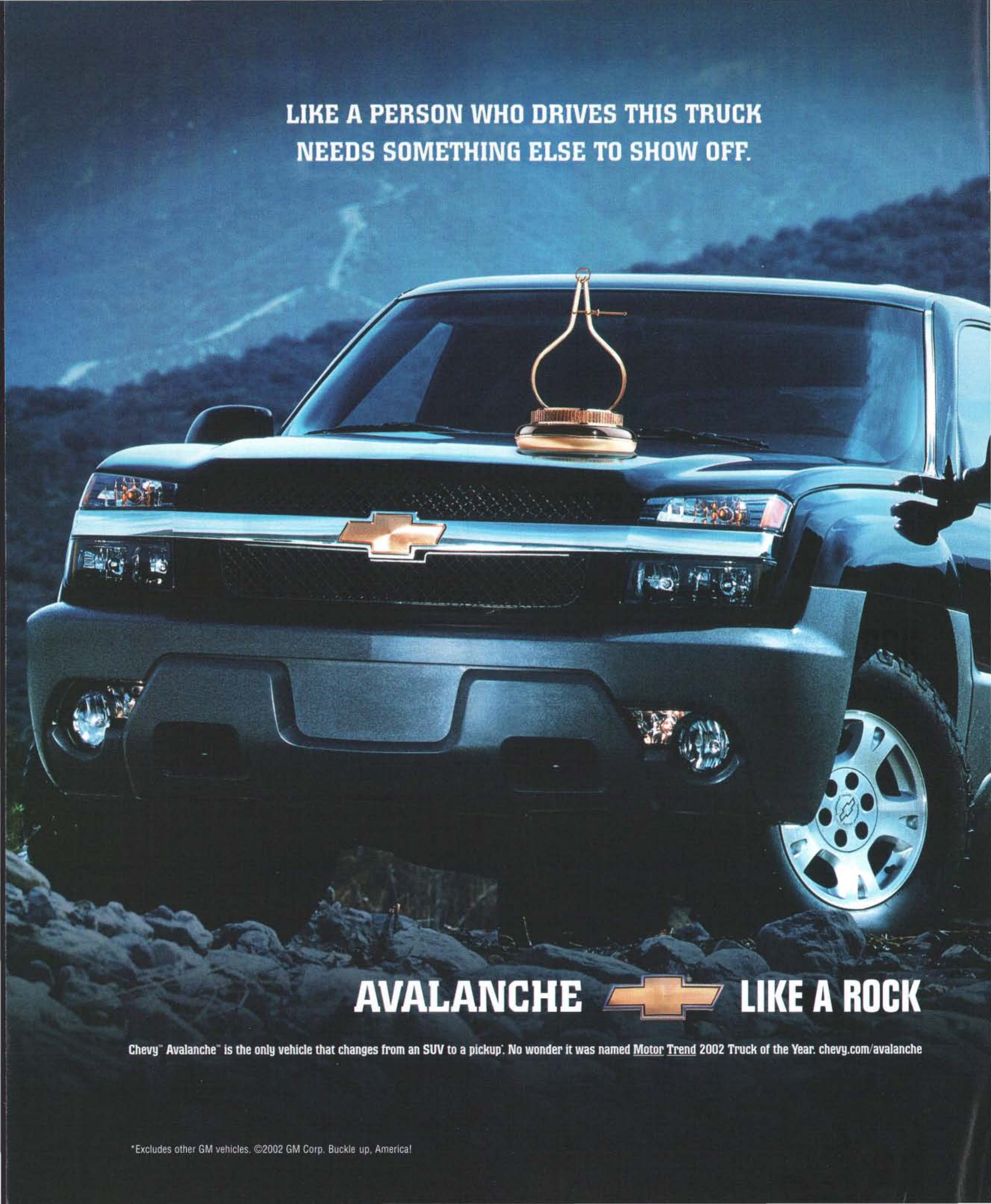

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Smartphones

A true smartphone can send and receive email, act as a PDA, surf the Web – the real one, not just WAP – and, of course, make calls. If price alone doesn't narrow the field, look for a phone with tightly integrated features that's easy to tote, makes entering info a snap, and lasts as long as possible between battery recharges.

Handspring Treo 180

FIRST CLASS

Nokia 9290 Communicator

Affectionately called "the brick," Europe's most popular smartphone compensates for its 8.6-ounce heft by doing nearly everything a laptop can do. The generous keyboard makes for easy pecking, and the speakerphone automatically turns on when you open the brick for a call. Although the bundled HTML browser is a bit sluggish, perks like the vivid 4,096-color display, Mobile RealPlayer, Symbian OS, and 10 hours of talk time elevate the 9290 to an almighty all-in-one. 9290 Communicator: $699. Nokia: (888) 665 4228, *www.nokia.com*.

BUSINESS CLASS

Samsung SPH-I300

Even without a keyboard or physical dial pad, the Palm-powered SPH-I300 shines thanks to its decent 256-color touchscreen with a built-in Graffiti window. The display turns itself off during calls, stretching talk time to four hours. The SPH-I300 is a portable 6 ounces, but it lacks a protective cover, so smudge marks are inevitable. Top-notch rendering makes browsing the Web a breeze. SPH-I300: $499. Samsung: (800) 726 7864, *www.samsungusa.com*.

COACH

Handspring Treo 180

Designed from the bottom up to break convergence ground, the Treo 180 is a flip phone, Palm organizer, and messaging maven wrapped in an ultracompact package. At 5.2 ounces, it's the lightest smartphone yet. And with the Blackberry-style keyboard, you can access contacts in just a few taps. It's too bad the Treo manages only 2.5 hours of talk time; but unlike the 9290 and SPH-I300, it can be upgraded to next-gen networks (in this case, GPRS) once they're fully deployed. Treo 180: $399. Handspring: (888) 565 9393, *www.handspring.com*.

Digital Photofinishing Services

Sitting on a backlog of unprocessed digital pics? The easiest way to turn them into glossies ready for framing is through an online photofinishing service. Consider print quality and fees, and then order and processing times. Many services offer great extras, such as tips for selecting print sizes – a big help for overly optimistic shutterbugs who want to avoid grainy images.

Apple iPhoto

FIRST CLASS

Image-Edit & Art

This finishing lab meets graphics studio specializes in making custom alterations to digital pictures. You can have pictures professionally lightened, hand-retouched (good-bye red eyes), or fully restored. It even managed the difficult task of erasing an ex from a hi-res group shot. The results, received in less than a week through regular post, were astonishing: The ex disappeared, and Image-Edit's pros reconstructed the billowing drapes in the background. Custom finishing: $25 and up per photo. Image-Edit & Art: (866) 668 8880, *www.image-edit.com*.

BUSINESS CLASS

Apple iPhoto

The iPhoto desktop software lets you order any number of pictures with a single click. While Microsoft's Windows XP has similar desktop capability, the simplicity of iPhoto can't be beat – though it works only on the Mac. Photos straight from the camera were ordered in minutes, and the prints came within a week via snail mail. Like the other services, iPhoto lets you create a free online gallery so you can share your camera work with your cohorts. iPhoto: 49 cents to $4 per photo. Apple: (800) 692 7753, *www.apple.com/iphoto*.

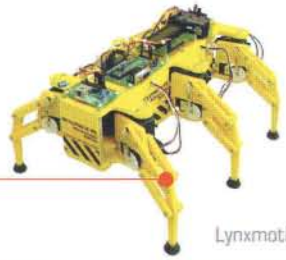
COACH

dotPhoto

It doesn't get any cheaper than dotPhoto. The service has the lowest prices online for individual pics, and you can join a monthly family plan to drive the rate down to 19 cents per 4-by-6 glossy. Considering the price of photo-inkjet paper, that's less than running off digital images at home. (It also works out to be about 16 cents less than using an offline store.) The fun part: Our prints arrived in about a week, looking nearly as good as those from the more expensive outfits. Photofinishing: 29 cents to $3 per photo. dotPhoto: +1 (609) 434 0340, *www.dotphoto.com*.

Programmable Robot Kits

Get into the *BattleBots* action by building your own Ballbreaker, Deathstar, or Armageddon. These do-it-yourself kits contain the same microcontroller brains as those found in some of the cable TV show's bots. None requires more than a day to assemble, and all are surprisingly straightforward to operate.



Lynxmotion Hexapod IIPE

FIRST CLASS

Lynxmotion Hexapod IIPE

The Hexapod is the most complex and time-consuming robot to piece together, but if you've tackled advanced car and spaceship models before, you can handle it. The bot's 12 motors and 6 legs can haul a 2-pound payload with ease. It's preprogrammed to scuttle around quickly on smooth surfaces and slow down when traversing carpet. Like the others below, its microcontroller relies on Basic code. Write your own, or download commands from the kit's software. Hexapod IIPE: $693. Lynxmotion: +1 (309) 382 1816, *www.lynxmotion.com*.

BUSINESS CLASS

Parallax Boe-Bot

Building this bot is about as difficult as painting a Lichtenstein by numbers. The kit's well organized, the manuals are flawless, and there's no soldering required (which cuts construction time to two hours) – no surprise, considering that the Boe-Bot gets its name from the Board of Education. The machine employs wire whiskers to avoid objects in its path and can be programmed to follow a line or light beam, or to communicate with other bots through infrared. In living-room tests, the Boe-Bot bullied the WAO-G with ease. Boe-Bot: $219. Parallax: (888) 512 1024, *www.parallaxinc.com*.

COACH

WAO-G

Only want to spend an hour perfecting your bot? Then the WAO-G is for you. The Japlish instructions are tough to follow, but assembling it is a blast and it requires no metalworking. Compared with pricier rovers, this unit has limited functions. Its built-in, 26-button keypad lets you program it without a computer. Or you can load up the kit's PC software and write Basic routines from your desktop. When the bot hits an object, sensors tell it to back up and try another route. WAO-G: $99. PC interface kit: $30. Robot Store: (800) 374 5764, *www.robotstore.com*.

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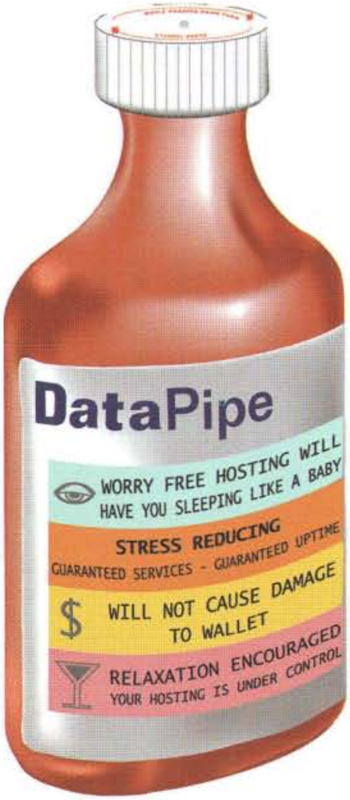
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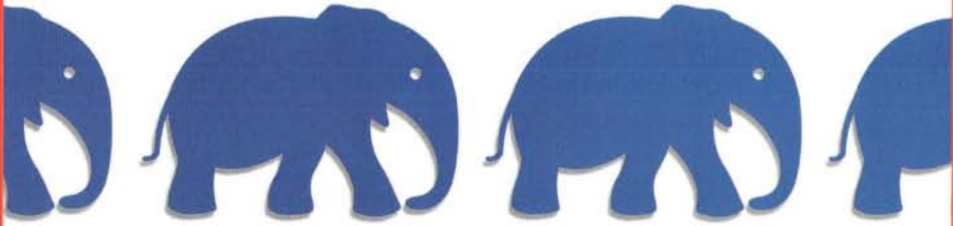

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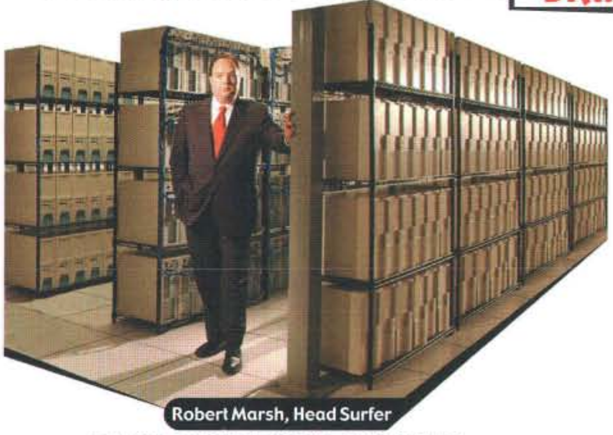
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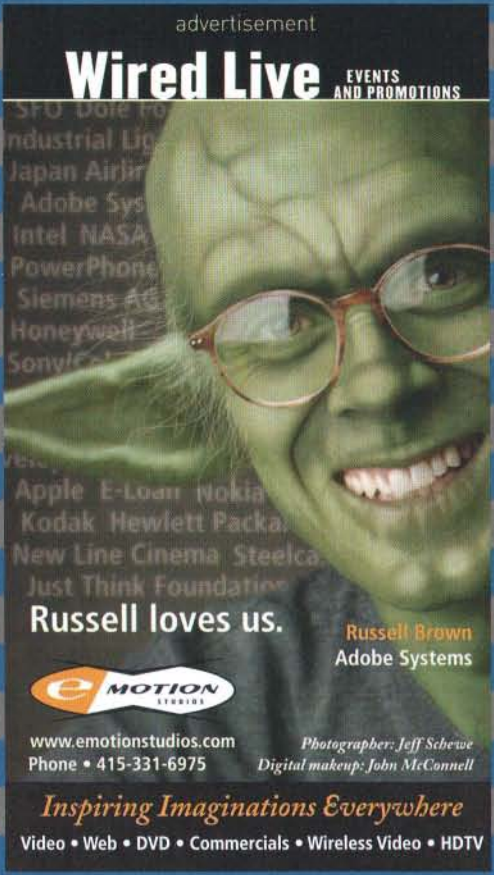

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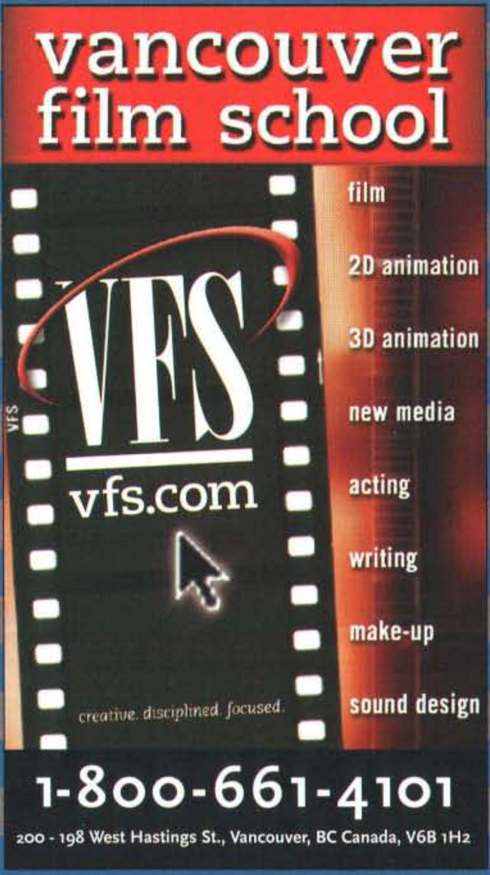

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(See page 15.)

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San Francisco, CA 94107-1815

Entries for the August issue must be received no later than May 1. One winner will be chosen based on the most unusual entry on or about May 10. One entry per person permitted. All entries become the property of the sponsor and will not be acknowledged or returned. All decisions by the judges are final. Grand prize: one (1) *Wired* T-shirt (approximate retail value $30). Void in Puerto Rico, the Canadian province of Quebec, and where prohibited. Subject to all federal, state, local, and provincial laws and regulations. Income and other taxes, if any, are the sole responsibility of the winner. No substitution for prize except by the sponsor, in which case a prize of equal or greater value will be substituted. Prize is not transferable. Winner may be required to sign an Affidavit of Eligibility and Liability/Publicity/Permission release within 14 days or an alternate winner may be chosen.

By submitting an entry, entrant understands and consents that the entry may be published by *Wired* and others it authorizes in any and all media now known or hereafter developed. Acceptance of the grand prize constitutes consent to use the winner's name, likeness, and entry for editorial, advertising, and publicity purposes without further compensation (except where prohibited by law).

For the name of the grand-prize winner, send a self-addressed, stamped envelope to Wired "Return to Sender" Contest Winner (August), 520 Third Street, 3rd Floor, San Francisco, CA 94107-1815, after May 10.

ALTOIDS

Muscle Car Instant Win Game

OFFICIAL RULES

NO PURCHASE NECESSARY. Game open only to U.S. residents age 18 or older. Game void where prohibited by law. Game starts on or about February 1, 2002, and is scheduled to end on June 30, 2003.

HOW TO PLAY. Look for a potential winning game piece inside specially marked regular tins of Altoids Peppermint, Cinnamon or Wintergreen flavors. If you find a regular tin that contains a potential winning game piece, you win the prize indicated, subject to verification. Non-winning specially marked regular tins WILL NOT CONTAIN a game piece or notice of any kind inside.

PRIZE CLAIMS. Sign your potential winning game piece, and type or print the following information on a 3"x 5" card/paper: your full name, complete address with ZIP Code, date of birth, and day/evening phone numbers with area codes, and mail along with the potential winning game piece in a business size (#10) envelope to: Altoids Muscle Car Game, P.O. Box 27172, Golden Valley, MN 55427-0172. Prize claim must be mailed via certified mail (return receipt requested) and must include original potential winning game piece. Retain a photocopy of your game piece for your records. All prize claims must be received by June 30, 2003. Upon verification, winners will be notified by mail.

ALTERNATE METHOD OF PARTICIPATION. To participate without purchase, hand print your full name, complete address with ZIP Code, date of birth, and day/evening phone numbers, with area codes, on a 3"x 5" card/paper, insert into a business size (#10) envelope and mail to: Altoids Muscle Car Game — Game Play Request, P.O. Box 3311, Maple Plain, MN 55593-3311, to be received by June 30, 2003. One game play per request; one request per outer mailing envelope. No mechanical reproductions or photocopies of requests will be accepted. The independent judging organization will play for you and notify you by mail ONLY if you are a potential winner.

PRIZES/APPROXIMATE RETAIL VALUE (ARV)/ODDS OF WINNING.
Three (3) Prizes: A choice of (a) a check in the amount of $40,000 OR (b) a "muscle car." In the event winner chooses a muscle car, Sponsor shall purchase a previously owned automobile, after consultation with winner, up to a maximum Purchase Price of $40,000. "Purchase Price" includes cost of the car, plus sales tax, licensing and registration fees, and, if applicable, delivery charges from dealership to winner's place of residence. Prize will be awarded "as is" and winner agrees to look solely to manufacturer or dealership with respect to any warranties and guarantees related to the "muscle car" prize. ARV: $40,000 each. Odds of winning: 1:3,333,934. Total ARV of all prizes: $120,000. Unclaimed prizes will not be awarded.

CONDITIONS ON PRIZES. Potential winners will be required to execute and return an Affidavit of Eligibility, Release of Liability and a Publicity Release, where legal, within 14 days of date of congratulatory letter. Failure to return all executed documents within the allotted time may result in disqualification and prize forfeiture. All taxes on prizes are solely the responsibility of prizewinners. Acceptance of prize offered constitutes permission to use winner's name and/or likeness for advertising/trade purposes without further compensation, unless prohibited by law. Prizes will be awarded within 8–10 weeks after verification of prize claim. No substitution of prize permitted, unless prize is generally unavailable, in which case a prize of equal or greater value will be substituted, at discretion of Sponsor.

VERIFICATION. All game pieces are subject to verification. Game pieces are void and will be rejected if not obtained through authorized, legitimate channels or if any part is illegible, mutilated, altered, counterfeited or tampered with in any way, or if materials contain printing, production, typographical, mechanical or other errors.
If because of error (or for any other reason) there are more prize claims than prizes offered as stated in these Official Rules, a random drawing will be held from among all eligible claimants to award only the number of prizes as stated in these Official Rules. In no event will Sponsor be liable for more than the stated number of prizes in these Official Rules. Any attempt to defraud Sponsor or the official judging agency in any way will be prosecuted to the fullest extent of the law and person(s) attempting same will be disqualified and ineligible for prizes.

ELIGIBILITY. The following categories of persons are not eligible to participate or win: employees of Sponsor, its advertising and promotion agencies and their respective parent companies, affiliates, subsidiaries, sales representatives or distributors and persons who are members of the immediate family or who reside in the same household as persons in any of the above categories.

CONDITIONS OF PARTICIPATION. By participating, participants agree to abide by and be bound by the Official Rules and all decisions of the judges, which are final and binding in all respects. Submission of game materials including but not limited to prize claims is solely the responsibility of the participant. Sponsor and its agencies are not responsible for late, lost, misdirected, damaged, illegible, delayed, destroyed, incomplete or postage-due mail, game play requests or prize claims. All game materials submitted become the sole property of the Sponsor and will not be returned. Winning game pieces and/or prizes may not be assigned or transferred prior to award. In the event of non-compliance with the requirements set forth in these Official Rules, prize may be forfeited. Limit 1 prize per individual, family or household.

WAIVER. By entering this promotion, participant waives all rights to claim punitive, incidental and consequential damages, attorneys' fees or any damages other than actual out-of-pocket costs incurred to enter.

WINNERS LIST. For a list of winners, send a self-addressed, stamped envelope to: Altoids Muscle Car Game — Winners List, P.O. Box 3312W, Maple Plain, MN 55593-3312. Sponsor: Kraft Foods North America, Inc., Northfield, IL 60093.

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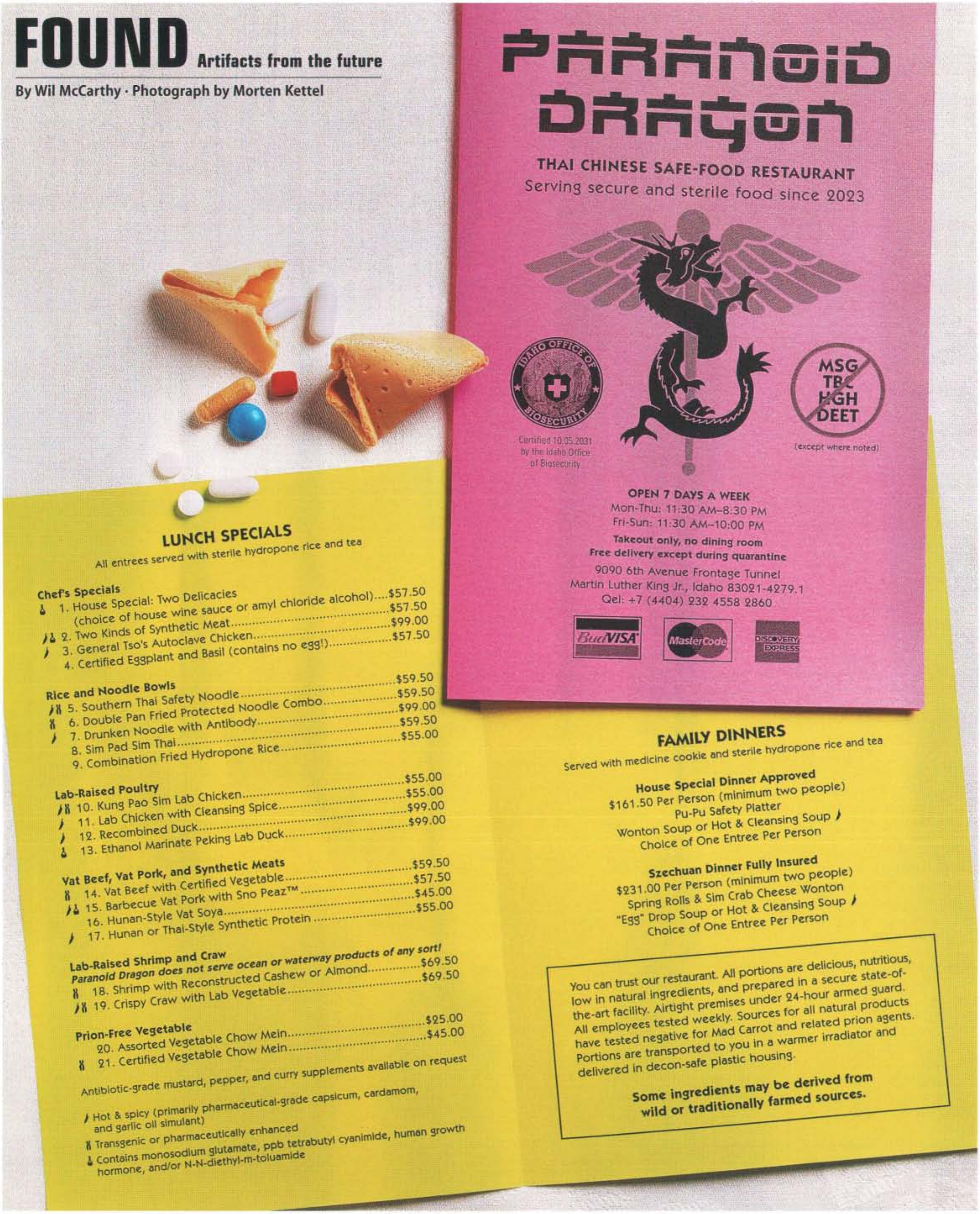
FOUND Artifacts from the future

By Wil McCarthy · Photograph by Morten Kettel



PARANOID DRAGON

THAI CHINESE SAFE-FOOD RESTAURANT
Serving secure and sterile food since 2023

Certified 10.05.2031
by the Idaho Office
of Biosecurity

(except where noted)

OPEN 7 DAYS A WEEK
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Fri-Sun: 11:30 AM–10:00 PM

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Free delivery except during quarantine

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Martin Luther King Jr., Idaho 83021-4279.1
Qel: +7 (4404) 232 4558 2860

LUNCH SPECIALS

All entrees served with sterile hydropone rice and tea

Chef's Specials	
🧪 1. House Special: Two Delicacies (choice of house wine sauce or amyl chloride alcohol)	$57.50
🌶🧪 2. Two Kinds of Synthetic Meat	$57.50
🌶 3. General Tso's Autoclave Chicken	$99.00
4. Certified Eggplant and Basil (contains no egg!)	$57.50
Rice and Noodle Bowls	
🌶🧬 5. Southern Thai Safety Noodle	$59.50
🧬 6. Double Pan Fried Protected Noodle Combo	$59.50
🌶 7. Drunken Noodle with Antibody	$99.00
8. Sim Pad Sim Thai	$59.50
9. Combination Fried Hydropone Rice	$55.00
Lab-Raised Poultry	
🌶🧬 10. Kung Pao Sim Lab Chicken	$55.00
🌶 11. Lab Chicken with Cleansing Spice	$55.00
🌶 12. Recombined Duck	$99.00
🧪 13. Ethanol Marinate Peking Lab Duck	$99.00
Vat Beef, Vat Pork, and Synthetic Meats	
🧬 14. Vat Beef with Certified Vegetable	$59.50
🌶🧪 15. Barbecue Vat Pork with Sno Peaz™	$57.50
16. Hunan-Style Vat Soya	$45.00
🌶 17. Hunan or Thai-Style Synthetic Protein	$55.00
Lab-Raised Shrimp and Craw *Paranoid Dragon does not serve ocean or waterway products of any sort!*	
🧬 18. Shrimp with Reconstructed Cashew or Almond	$69.50
🌶🧬 19. Crispy Craw with Lab Vegetable	$69.50
Prion-Free Vegetable	
20. Assorted Vegetable Chow Mein	$25.00
🧬 21. Certified Vegetable Chow Mein	$45.00

Antibiotic-grade mustard, pepper, and curry supplements available on request

🌶 Hot & spicy (primarily pharmaceutical-grade capsicum, cardamom, and garlic oil simulant)
🧬 Transgenic or pharmaceutically enhanced
🧪 Contains monosodium glutamate, ppb tetrabutyl cyanimide, human growth hormone, and/or N-N-diethyl-m-toluamide

FAMILY DINNERS

Served with medicine cookie and sterile hydropone rice and tea

House Special Dinner Approved
$161.50 Per Person (minimum two people)
Pu-Pu Safety Platter
Wonton Soup or Hot & Cleansing Soup 🌶
Choice of One Entree Per Person

Szechuan Dinner Fully Insured
$231.00 Per Person (minimum two people)
Spring Rolls & Sim Crab Cheese Wonton
"Egg" Drop Soup or Hot & Cleansing Soup 🌶
Choice of One Entree Per Person

You can trust our restaurant. All portions are delicious, nutritious, low in natural ingredients, and prepared in a secure state-of-the-art facility. Airtight premises under 24-hour armed guard. All employees tested weekly. Sources for all natural products have tested negative for Mad Carrot and related prion agents. Portions are transported to you in a warmer irradiator and delivered in decon-safe plastic housing.

Some ingredients may be derived from wild or traditionally farmed sources.

WHILE YOU WERE GONE

TO: MR2 SPYDER

FROM:

MESSAGE:

- SEQUENTIAL MANUAL TRANSMISSION IS AVAILABLE.
- SHIFTS W/O CLUTCH PEDAL.

☐ URGENT
☐ NOT SO URGENT
☐ CALL BACK
☐ DON'T CALL BACK

(800) 468-6968

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